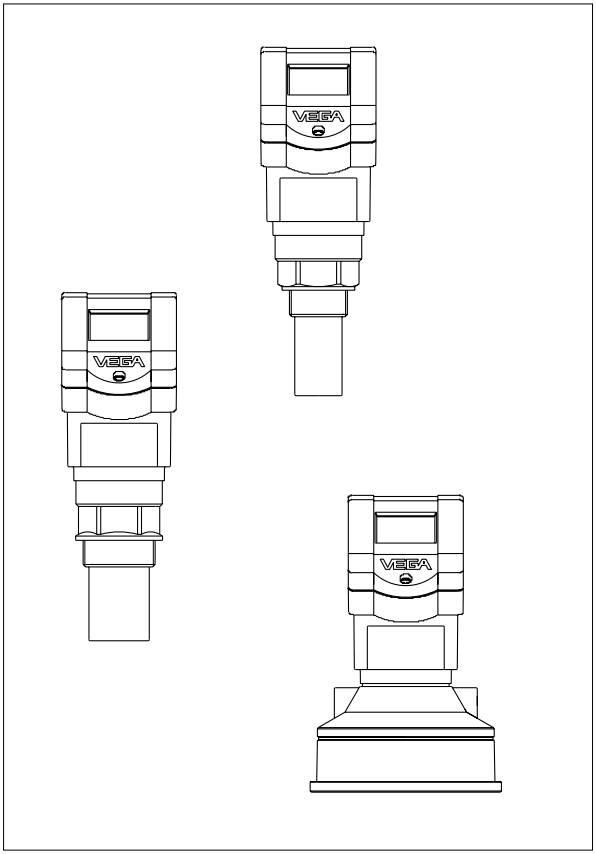
Level and Pressure

Operating Instructions

VEGASON 51P ... 53P (Profibus PA)



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Safety information

Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

For safety and warranty reasons, any internal work on the instruments, apart from that involved in normal installation and electrical connection, must be carried out only by qualified VEGA personnel.

Note Ex area

Please note the approval documents (yellow binder), and especially the included safety data sheet.

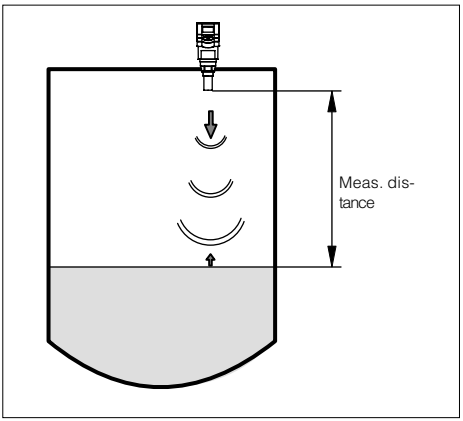
1 Product description

1.1 Function

Continuous level measurement with ultrasonic sensors is based on the running time measurement of ultrasonic pulses.

Measuring principle

High performance piezoceramic transducers emit focused 70 kHz ultrasonic pulses which are reflected by the product surface. The measurement electronics prepares a precise image of the environment from the reflected ultrasonic pulses. The transducers work both as transmitter and receiver. As receiver, the transducers are high-sensitivity piezo microphones.



emission - reflection - reception

The measurement electronics precisely calculates the distance between transducer and medium from the speed of sound and the measured running time of the emitted sound impulse. The distance is then converted into a level-proportional signal and, in conjunction with the sensor parameter settings, made available as a precise, calibrated level value.

Since the speed of sound is subject to temperature influence, the transducer also continuously detects the ambient temperature, so that the level is precisely measured even in case of varying ambient temperature.

Output signal

The level-proportional Profibus PA measuring signal is processed and outputted completely digitally. Digital processing of the measuring signal ensures an accuracy which could be never reached by an analogue measuring signal, as the digital signal is always transmitted error-free right up to the last decimal point.
Varying line resistances or tiny leakage currents do not influence the accuracy of digital technology. The digital signal is always clear and unambiguous.

The digital signal, mirroring the adjusted measuring range of the sensor, can be modified by various parameter settings.

Display of measured values

As an option, the series 50 ultrasonic sensors can be equipped with an indicating instrument for direct, local level survey. The indicating instrument shows the precise level by means of the analogue bar graph and the digital number value. In addition to the indication in the sensor, you can have the level displayed with the VEGADIS 50 external indicating instrument at a distance of up to 25 m from the sensor. The external display of measured values operates, like the integrated display, independently of the PA output signal and can be modified through individual parameter settings.

1.2 Application features

Applications
- Level measurement of all liquids.
- Level measurement of solids (only short meas. distances) such as e.g. coal, ore, rocks, rock dust, cement, gravel, crushed rock, sand, sugar, salt, cereals, flour, granules, powder, dust, sawdust, wood chips.
- Flow measurement on various flumes.
- Gauge measurement, distance measurement, object monitoring and conveyor belt monitoring
- Display of measured values integrated in the sensor.
- Optional display separate from sensor.

Two-wire technology
- Supply and output signal on one two-wire cable.
- Output signal and signal processing completely digital, therefore maximum accuracy.
- Profibus profile 3 – sensor.

Rugged and precise
- Measurement unaffected by substance properties such as density, conductivity, dielectric constant…
- Suitable for corrosive substances
- Measuring ranges 0.25 m … 15 m.

Adjustment
- With adjustment software VEGA Visual Operating (VVO) on the PC
- With detachable adjustment module MINICOM
- With Simatic-PDM adjustment program.

Connection to any process
- G $1^1/_2$ A, $1^1/_2$" NPT.
- G 2 A, 2" NPT.
- Compression flange DN 100, ANSI 4"

Approvals
- CENELEC, ATEX, PTB, FM, CSA, ABS, LRS, GL, LR, FCC.

1.3 Profibus output signal

PROcess FIeld BUS (PROFIBUS) is the result of a joint project of thirteen companies and five universities. The companies Bosch, Klöckner-Möller and Siemens played a decisive role. The specifications of the bus are described in the protocol layers 1, 2 and 7 of the ISO/OSI reference model and are available from the PNO (Profibus user organisation). Layers 3 … 5 have not yet been developed as a standard, leaving Profibus with far-reaching perspectives for the future.

Today approx. 600 companies make use of Profibus technology and belong to the PNO. Profibus FMS stands for Fieldbus Messaging Specification, Profibus DP for Decentralise Periphery and Profibus PA for Process Automation.

As a process automation bus, Profibus PA enables power supply over the bus. Up to 32 sensors can be operated on a shielded two-wire cable that carries both power supply and measuring signal. In Ex areas, up to ten sensors can be connected from the PA level to one two-wire cable (EEx ia).

Bus structure

The DP and PA bus consists of up to 126 master and slave participants. Data are always exchanged from point to point, with the data traffic being exclusively controlled and checked by master devices. Communication is carried out according to the Token-Passing procedure. This means that the master owning the Token, can contact the slaves, give instructions, enquire data and cause the slaves to receive and transmit data. After the work is done or after a predetermined time interval, the Token is passed on by the master to the next master.

Master-Class 1
is the actual automation system, i.e. the process control computer or the PLC enquires and processes all measured values.

Master-Class 2
One or several Master-Class 2 can operate in a Profibus network. As a rule, Master-Class 2 devices are engineering, adjustment or visualisation stations. The VEGA adjustment software VVO (VEGA Visual Operating) operates as Master-Class 2 participant on the DP bus and can work on an engineering PC, on an adjustment PC or on the process control computer and can access any VEGA sensor on the PA level.

Instrument master file
A so-called GSD file is attached to a VEGASON Profibus sensor. This file is necessary for integrating the sensor into the bus system. The GSD file (instrument master file) contains, beside the sensor name and the manufacturer, the sensor-specific communication parameters which are necessary for a stable integration of the sensor in the bus. Load the GSD file belonging to the sensor into your bus configuration program. If the GSD file is not available, it can be loaded from the VEGA homepage: http://www.vega.com.
Do not mix up the GSD file with the EDD (Electronic Device Description) necessary for the PDM environment (this can be also found on the VEGA homepage).

1.4 Adjustment

Each measuring situation is unique. For that reason, every ultrasonic sensor needs some basic information on the application and the environment, e.g. which level means "empty“ and which level "full“. Beside this "empty and full adjustment“, many other settings and adjustments are possible with VEGASON ultrasonic sensors. The output of echo curves or the calculation of vessel linearisation curves by means of vessel dimensions are only two examples.

Profibus adjustment structure

In the Profibus environment there are different adjustment concepts and adjustment tools which often differ considerably from manufacturer to manufacturer. From the user's point of view, a manufacturer-independent adjustment program which could be directly operated on the Profibus DP, but also from a central point (e.g. the engineering station or the process control) would be ideal.

In the past, only the program "SIMATIC PDM“, based on the HART® adjustment structure, could fulfill this wish. However, this program also has the same limitation as HART®. As with HART®, an instrument-specific database is required for comprehensive adjustment with PDM (Process Device Managing). Without this, only basic instrument functions, such as live adjustment, are available. In the PDM environment, this instrument-specific database is called EDD (Electronic Device Description). Completely analogous to the HART® environment, the PDM environment also requires a DD (Device Description) for each (with the exception of VEGA HART® instruments) sensor.

We are aware of the disadvantages of the HART® environment: for each sensor/participant an individual DD must be loaded which, in addition, must always be the latest and most up-to-date DD. Special adjustment options such as e.g., the output of an echo curve, are available neither with HART® nor with PDM. The SIMATIC-PDM adjustment concept was tailored more to the basic adjustment functions. Intelligent, communicative sensors, however, make much more additional information available to the measurement loop and open up completely new adjustment possibilities. PDM was not conceived with such things in mind. Really user-friendly adjustment is out of the question. That's history now.

The legitimate wish of many Profibus users for a manufacturer-independent adjustment tool without EDD has now been realised with PACTware™ [1]. An association of a number of process technology companies developed PACTware™: a Process Automation Configuration Tool, running different manufacturer software tools under a standardized user interface and adjustment structure. Specialists call this technology Field Device Transcription. Just as different as Windows printer drivers enable operation of completely different printers under one user interface, PACTware™ enables operation of all field instruments under one user interface. Instrument-specific databases (EDD), like those required for SIMATIC PDM, are not necessary.

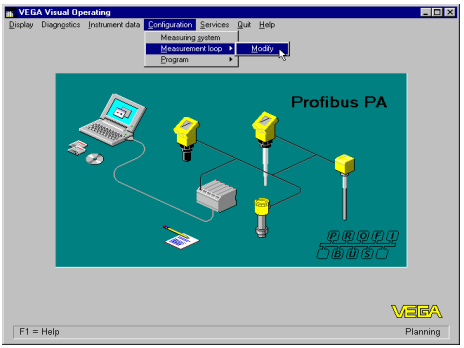
As a result of this development, three adjustment media are now available for VEGA-Profibus sensors:

- adjustment with the PC and the adjustment program VVO (VEGA Visual Operating) as a stand-alone tool which can, however, also run as a subprogram of PACTware™
- adjustment with the detachable adjustment module MINICOM in the sensor
- adjustment with the SIMATIC PDM adjustment program (requires EDD instrument databases for advanced adjustment)

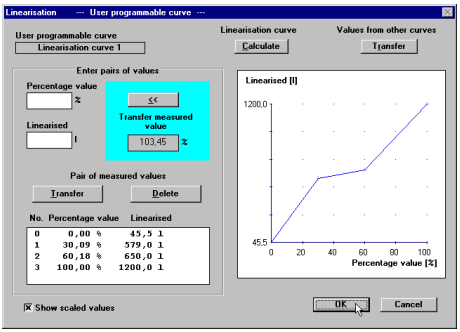
Adjustment with the adjustment program VVO - VEGA Visual Operating

Setup and adjustment of the ultrasonic sensors is generally done on the PC with the adjustment program VEGA Visual Operating (VVO) under Windows®. The program leads quickly through adjustment and parameter setting by means of pictures, graphics and process visualisations.

The VEGA adjustment software VVO (VEGA Visual Operating) operates either as a subprogram of the host program PACTware™ (according to the FDT concept) or as an independent adjustment program on any PC, engineering station or process control computer.



The adjustment program recognises the sensor type



Visualised input of a vessel linearisation curve

[1] presumably available until end of 2000

The VEGA adjustment program VVO can access the entire spectrum of adjustment options of VEGA sensors and, if necessary, can update the complete sensor software. To do this, the adjustment program must be installed on a PC which is equipped with a Profibus-Master-Class 2 interface card (Softing) (see diagram on following page).

The PC with the Profibus interface card can be connected directly at any point on the DP bus with the standard RS 485 Profibus cable.

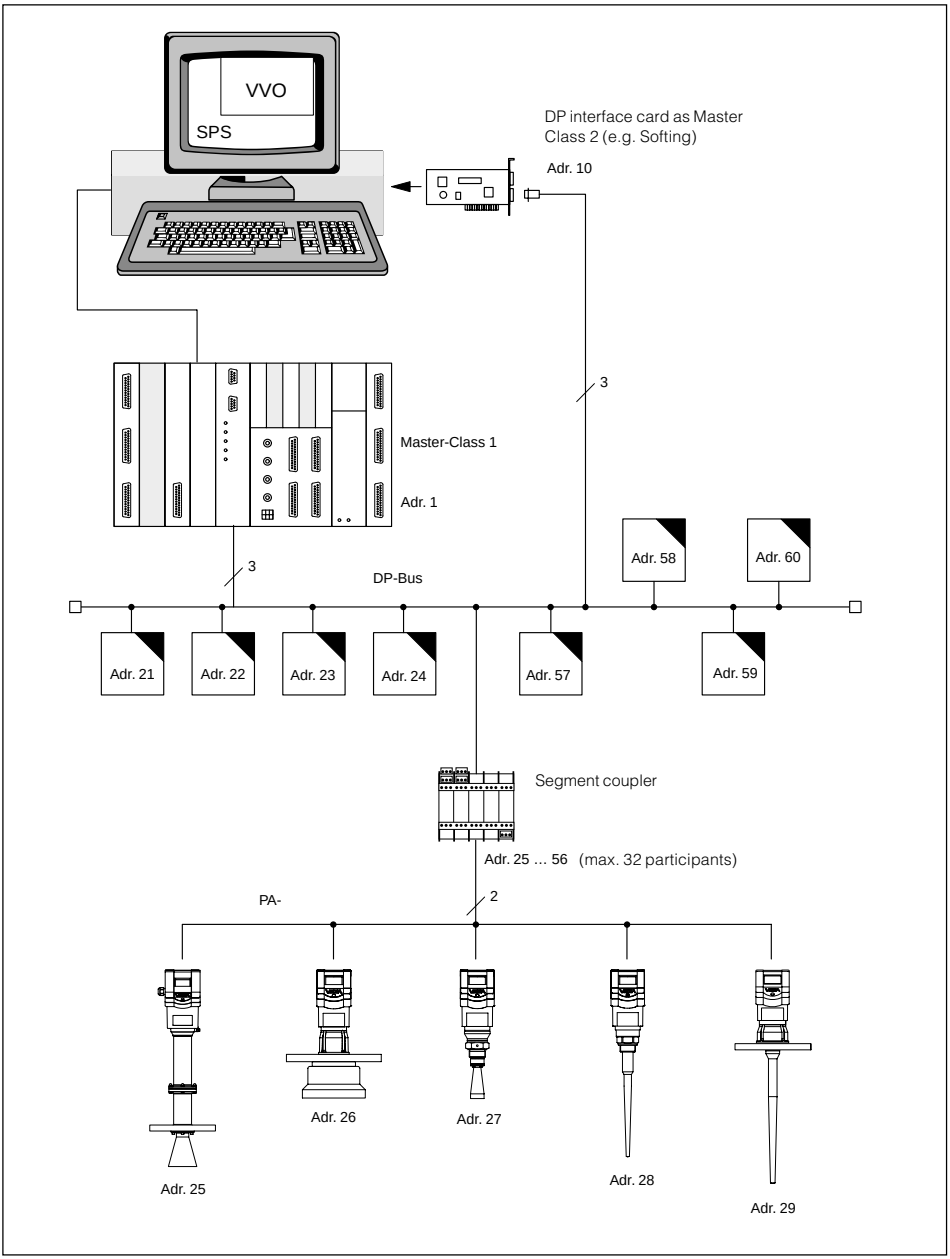
The adjustment and parameter data can be saved with the adjustment software on the PC and protected by passwords. If necessary, the adjustments can be transferred quickly to other sensors.

In practice, the adjustment program VVO is often installed as a tool on an engineering station or an adjustment station. VVO then accesses via the Profibus interface card (e.g. from Softing) as Master-Class 2 directly via the bus, from the DP level via the segment coupler on PA level and finally to the individual sensor, all VEGA sensors.

No DD necessary for adjustment with VVO

In addition to the instrument master file (GSD), with which a sensor is logged into the Profibus system, the majority of all Profibus sensors also requires along with the specific adjustment software a so-called EDD (Electronic Device Description). This is not the case with VVO. The adjustment software VVO can communicate at any time with all VEGA sensors without requiring a special database. Of course, all other VEGA sensors can be adjusted with the adjustment software as well (4 … 20 mA sensors or VBUS sensors). With VEGA sensors, it is not necessary to go looking for the latest EDD. This is the essential requirement of a manufacturer-independent adjustment program anticipated by many users.

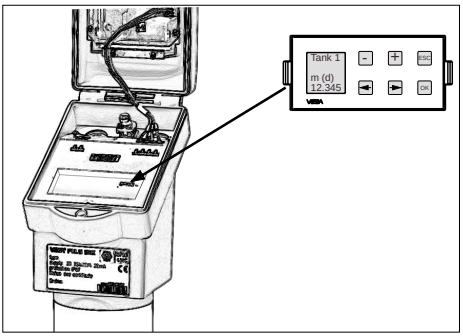
The above mentioned program PACTware™ is such a manufacturer-independent automation/configuration tool through which access to instruments of different manufacturers (Krohne, Pepperl + Fuchs, VEGA, VIKA-Bürkert…) is possible. The VEGA adjustment software VVO works as an independent tool or as a subprogram of PACTware™. Depending on the sensor/instrument currently being accessed, PACTware™ activates the necessary menu options.



Adjustment of the VEGASON ultrasonic sensors from the process control via a Profibus interface card in the process control computer or in an additional PC. The adjustment software VEGA Visual Operating (VVO) accesses the sensors bidirectionally via the interface (interface card).

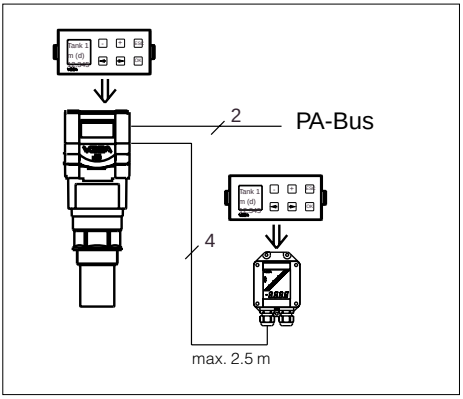
Adjustment with adjustment module MINICOM

With the small (3.2 cm x 6.7 cm) 6-key adjustment module with display in the sensor, the sensor-relevant adjustments can be carried out directly on the sensor.



Detachable adjustment module MINICOM

The adjustment module can be plugged into the ultrasonic sensor or into the optional, external indicating instrument.



Adjustment with detachable adjustment module. The adjustment module can be plugged into the ultrasonic sensor or the external indicating instrument VEGADIS 50.

With the adjustment module MINICOM, the sensor can be adjusted to the actual measuring conditions, and the basic functions can be set. In addition to the measuring conditions and simulation mode, the Profibus address can be adjusted and a false echo storage can be carried out, see "6.3 Adjustment with MINICOM".

Adjustment with the SIMATIC PDM adjustment program

To adjust all essential functions of the VEGA sensor with the adjustment station SIMATIC PDM from Siemens, a so-called EDD is required. Without this EDD, only the basic functions, such as min./max. live adjustment or the integration time, can be adjusted with the PDM adjustment program. Further important adjustment functions, such as the input of the "*Meas. environment*", a dry adjustment or a false echo storage are not available without EDD. After integration of the EDD files into the Simatic PDM adjustment software, all important adjustment functions are accessible. If the file is not on hand, the obligatory GSD (instrument master file) as well as the EDD (Electronic Device Description) necessary for PDM can be downloaded from the VEGA Homepage (http://www.vega.com).

2 Types and Profibus configuration

VEGASON series 50 sensors are a newly developed generation of extremely compact ultrasonic sensors. With very modest space requirements, they were developed for measuring distances of 0 … 15 m and for standard applications such as storage vessels, gauge measurement and buffer tanks.

Thanks to their diminutive housing dimensions and process fittings, the compact sensors are an inconspicuous and cost-effective solution to your level measurement applications. With the integrated display and a remarkable sensor intelligence, they can be used for applications in which the advantages of non-contact measurement could never before be realized.

VEGASON 50 ultrasonic sensors are perfectly suited to two-wire technology. The supply voltage and the output signal are transmitted via one two-wire cable. As output or measuring signal, the instruments produce a digital output signal (Profibus PA).

2.1 Survey

Short overview of sensor features

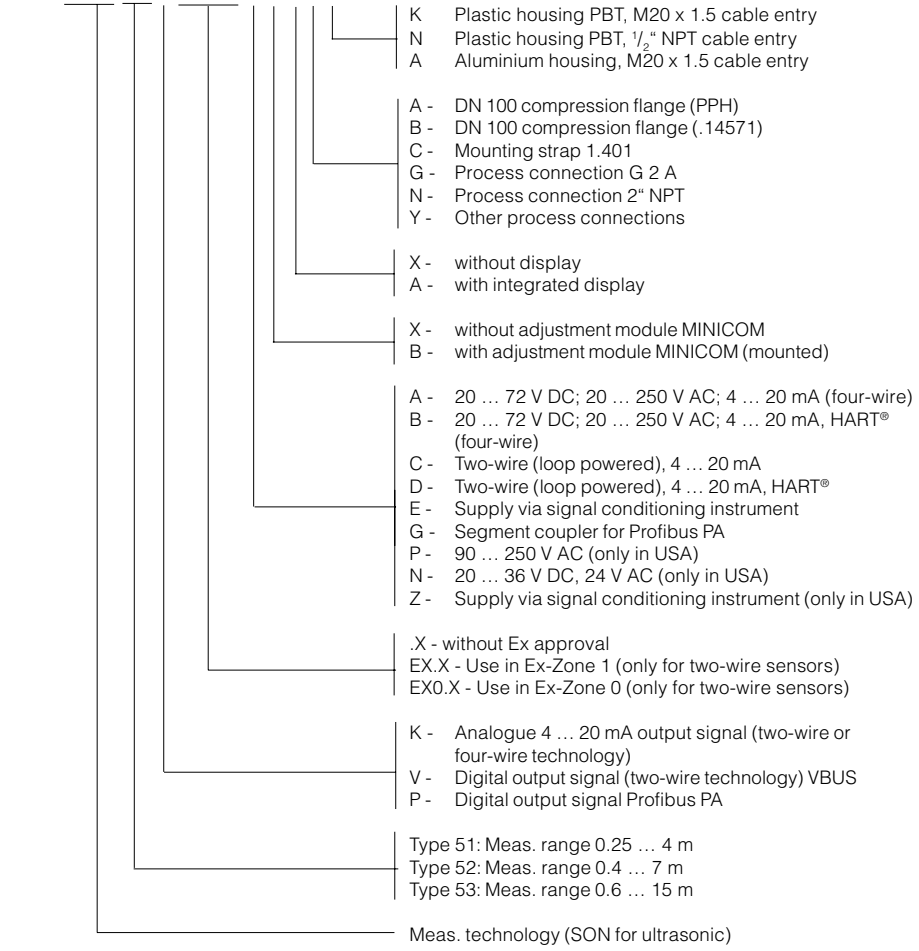
- Application preferably for solids and liquids.
- Measuring range 0.25 … 15 m.
- Ex approved in Zone 1 (IEC) or Zone 1 (ATEX) classification mark EEx ia [ia] IIC T6.
- Integrated display of measured values.

Overview

VEGASON	51P	52P	53P
Signal output – digital meas. signal (PA)	•	•	•
Voltage supply – PA-two-wire technology (voltage supply and signal output via one two-wire cable)	•	•	•
Process connection – G1 1/2 A; 1 1/2“ NPT – G 2 A; 2“ NPT – DN 100 compression flange	• – –	– • –	– – •
Adjustment with – PC with adjustment software VVO – adjustment module in the sensor – adjustment module in external indicating instrument – SIMATIC-PDM – PACTware™ (VVO runs as subprogram	 • • • • •	 • • • • •	 • • • • •
Meas. range in m – liquid – solid	0.25 … 4	0.4 … 7	0.6 … 15

Type code

VEGASON 52 P EX.XX X X X X X


K Plastic housing PBT, M20 x 1.5 cable entry
N Plastic housing PBT, 1/2" NPT cable entry
A Aluminium housing, M20 x 1.5 cable entry
A - DN 100 compression flange (PPH)
B - DN 100 compression flange (.14571)
C - Mounting strap 1.401
G - Process connection G 2 A
N - Process connection 2" NPT
Y - Other process connections
X - without display
A - with integrated display
X - without adjustment module MINICOM
B - with adjustment module MINICOM (mounted)
A - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA (four-wire)
B - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA, HART® (four-wire)
C - Two-wire (loop powered), 4 … 20 mA
D - Two-wire (loop powered), 4 … 20 mA, HART®
E - Supply via signal conditioning instrument
G - Segment coupler for Profibus PA
P - 90 … 250 V AC (only in USA)
N - 20 … 36 V DC, 24 V AC (only in USA)
Z - Supply via signal conditioning instrument (only in USA)
.X - without Ex approval
EX.X - Use in Ex-Zone 1 (only for two-wire sensors)
EX0.X - Use in Ex-Zone 0 (only for two-wire sensors)
K - Analogue 4 … 20 mA output signal (two-wire or four-wire technology)
V - Digital output signal (two-wire technology) VBUS
P - Digital output signal Profibus PA
Type 51: Meas. range 0.25 … 4 m
Type 52: Meas. range 0.4 … 7 m
Type 53: Meas. range 0.6 … 15 m
Meas. technology (SON for ultrasonic)

2.2 Bus configuration

The type of ultrasonic sensor you use depends on the process requirements and the mounting conditions, as well as on the requirements of your control, regulative, or process management system.

VEGASON 51P ... 53P Profibus ultrasonic sensors are instruments for use in the Profibus PA environment. Profile 3 has been implemented in the sensors. A measuring system consists of one or several sensors, one or several segment couplers and one DP master computer, such as e.g. a S7 PLC with Profibus interface or a process control system with Profibus DP-Master-Slot. The processing unit, e.g. the PLC, evaluates the level-proportional, digital measuring signals in a number of evaluation routines and puts them to use process-specifically.

On the following two pages, you will find a schematic diagram of the bus configuration.

The automation system as Master-Class 1 takes complete control of the bus. It reads out all signals cyclically and, if necessary, gives instructions to the participants (e.g. sensors). In addition, further master systems (e.g. visualisation systems or adjustment tools) can be connected to the DP bus. These systems operate as so-called Master-Class 2 participants. Like the Master-Class 1 system, they can read out signals, give instructions and operate in the acyclical mode.

A DP bus does not allow power supply via the signal cable, whereas the PA bus does. Both DP and PA require at least one screened two-wire cable. The DP bus can additionally have up to 8 cores (screened), through which supply cables can also be led.

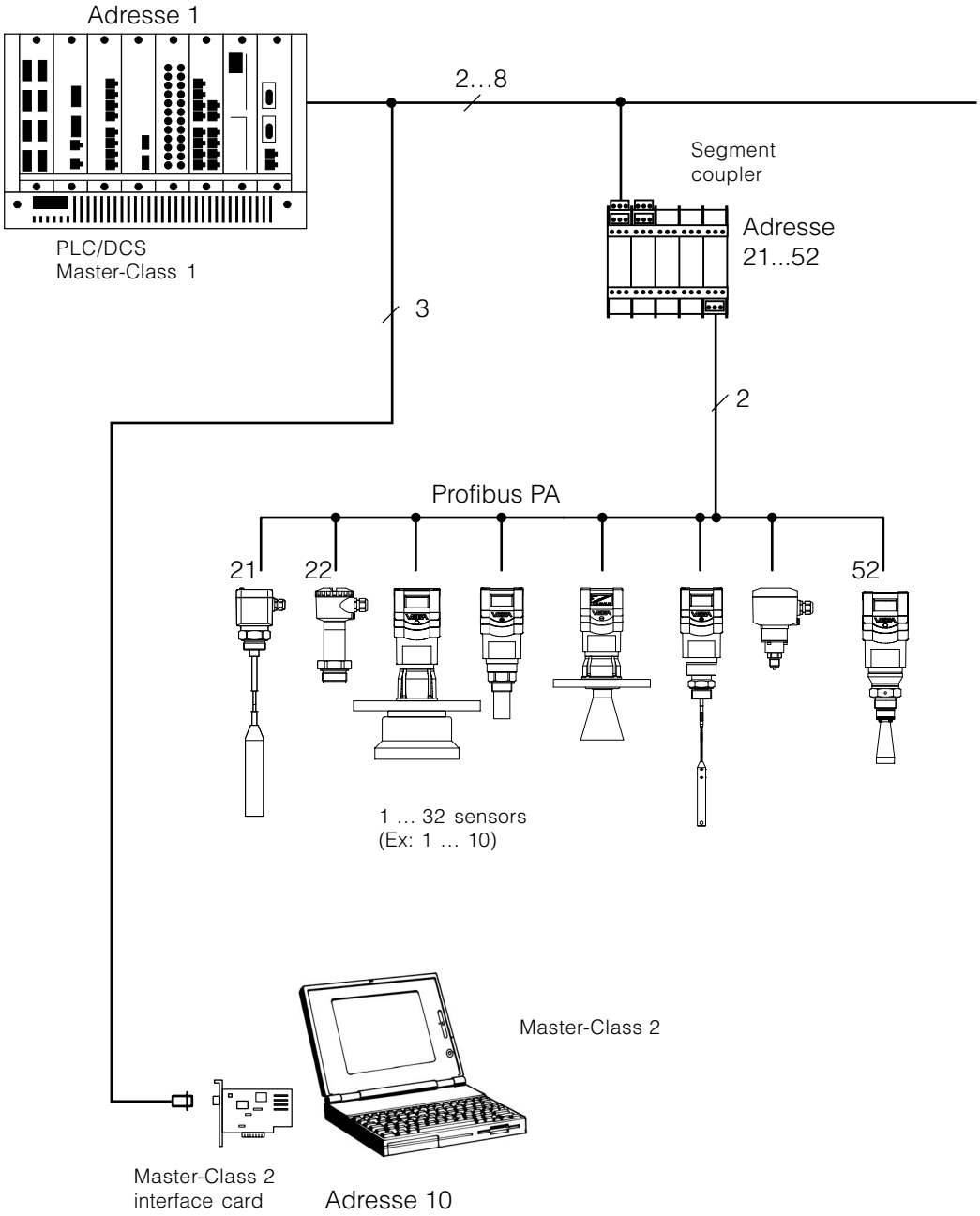
Each participant on the bus must have an address. The addressing covers both bus levels. A Profibus DP system can have max. 126 participants, including all participants on the PA level. In practice, each Master-Class 1 computer gets address 1 and the Master-Class 2 computers address 10 ... 20. As a rule, the slaves or participants get the addresses 21 ... 126. On the Profibus PA level, max. 32 sensors are possible on one PA segment coupler.

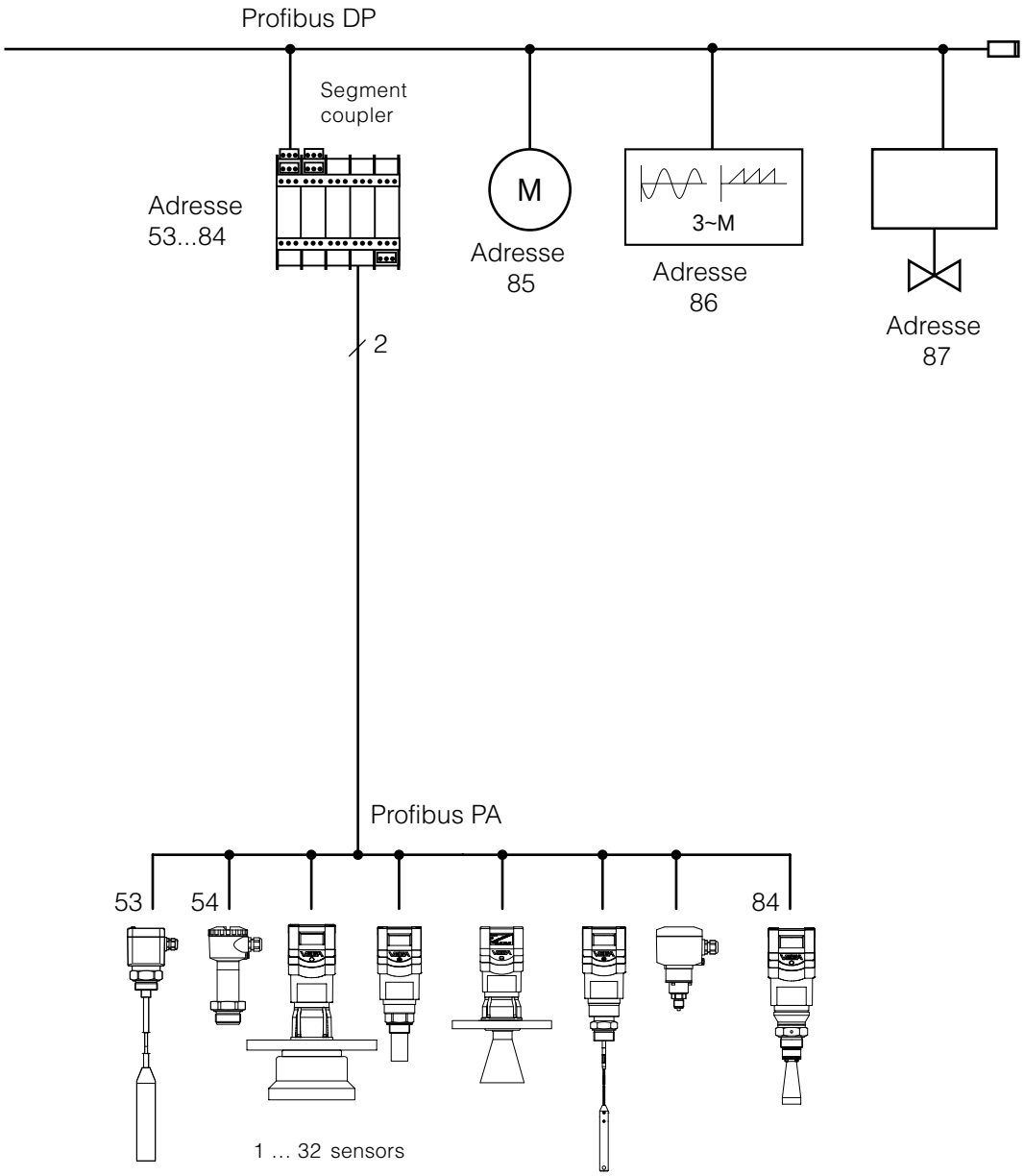
Ex environment

In Ex environment, intrinsically safe (EEx ia) PA sensors are used with Ex segment couplers. Generally, the number of PA sensors on a segment coupler (Ex or non Ex) depends on the current supplied by the sensors and from the current offered by the segment coupler. Segment couplers for EEx ia environment provide 90 ... 110 mA. The number of sensors results from the sum of:

- the basic power consumption of all sensors
- plus 9 mA communication signal
- plus the leakage currents of all sensors
- plus a recommended current reserve (approx. 10 mA)

The min. basic current has been set at 10 mA according to the Profibus specification. VEGA Profibus sensors draw a constant basic current of 10 mA and operate without leakage current requirement. This allows up to 10 VEGA sensors in Ex environment to be operated on one segment coupler.


Adresse 1
2...8
Segment
coupler
Adresse
21...52
PLC/DCS
Master-Class 1
3
2
Profibus PA
21
22
52
1 ... 32 sensors
(Ex: 1 ... 10)
Master-Class 2
Master-Class 2
interface card
Adresse 10


Profibus DP
Segment coupler
Adresse 53...84
M
Adresse 85
3~M
Adresse 86
Adresse 87
2
Profibus PA
53
54
84
1 ... 32 sensors

3 Technical data

3.1 Technical data

Power supply

Supply voltage	9 … 32 V DC
Power consumption	constant 10 mA (no leakage current output)
Output voltage U_O of the segment coupler, (depending on the segment coupler used) see PA specification e.g.	
- non Ex	e.g. 22 V DC (nominal voltage of the segment coupler) max. 32 sensors on one two-wire cable
- Ex	13.5 V DC nominal voltage of the segment coupler max. 10 sensors on one two-wire cable (typically 8 sensors)
Cable load	dependent on the segment coupler, see technical data of the segment couplers and Profibus specification

Measuring range (reference plane is the transducer end)

	Liquids	Solids
VEGASON 51	0.25 … 4 m	0.3 … 2 m
VEGASON 52	0.4 … 7 m	0.5 … 3.5 m
VEGASON 53	0.6 … 15 m	0.75 … 7 m

Output signal (see also "3.3 Data format of the output signal")

digital (Profibus)	the digital output signal (meas. signal) is modulated onto the power supply and further processed in the PLC or in the process management system
Integration time	0 … 999 seconds (adjustable)

Adjustment

- adjustment software VEGA Visual Operating on Master-Class 2 PC
- adjustment module MINICOM in the sensor or in the external indicating instrument (optional)
- process adjustment interface PACTware™ (VVO as subprogram)
- SIMATIC PDM in conjunction with Electronic Device Description (EDD)

Display of measured value (optional)

Liquid crystal display	
- in the sensor	scalable output of measured value as graph and as numerical value
- external, powered by the sensor	scalable output of measured value as graph and as numerical value, display can be separated up to 25 m from the sensor

Accuracy [1]

(typical values under reference conditions, all information relates to the nominal measuring range)

Characteristics	linear
Deviation in characteristics including linearity, reproducibility and hysteresis (determined acc. to the limit point method)	< 0.1 %
Linearity	better than 0.05 %
Average temperature coefficient of the zero signal	0.06 %/10 K
Resolution general	max. 1 mm
Resolution of the output signal	0.005 % or 1 mm

Characteristics [1]

(typical values under reference conditions, all information relates to the nominal measuring range)

Min. span between full and empty	> 20 mm (recommended > 50 mm)
Ultrasonic frequency (at 20°C)	
- VEGASON 51	70 kHz
- VEGASON 52	55 kHz
- VEGASON 53	34 kHz
Meas. intervals	1.0 s
Beam angle (at –3 dB acoustic power)	
- VEGASON 51	5.5°
- VEGASON 52	5.5°
- VEGASON 53	3°
Influence of the ambient temperature	negligible, is compensated by a dynamic temperature detection integrated in the transducer. The ambient temperature error without temperature compensation is 0.18 %/K
Influence of the process pressure	negligible within the approved sensor pressures
Adjustment time [2]	> 2 s (depending on the parameter adjustment)

[1] Similar to DIN 16 086, reference conditions according to IEC 770, e.g. temperature 15°C … 35°C; moisture 45 % … 75 %; pressure 860 mbar … 1060 mbar

[3] The adjustment time (also actuating time, response time or adjustment period) is the time the sensor requires to output the correct level (with max. 10% deviation) after a quick level change.

Ambient conditions

Ambient temperature on the housing	-40°C ... +80°C
Process temperature (transducer)	-40°C ... +80°C (StEx: -20°C ... +75°C)
Storage and transport temperature	-40°C ... +80°C
Vessel pressure	
- VEGASON 51, 52	-0.4 ... 2.0 bar (absolute 3 bar)
- VEGASON 53	-0.4 ... 1.5 bar (absolute 2.5 bar)
Protection	
- sensor	IP 67
- transducer, process	IP 68
Protection class	II
Overvoltage category	III
Self-heating at 40°C ambient temperature to	
- sensor	45°C
- transducer, process	55°C

Ex technical data

Comprehensive data included in the attached approval documents (yellow binder)

Classification ia	intrinsically safe
Classification mark	II 1G EEx ia IIC T6 or II 2G EEx ia IIC T6
Ex approved	Zone 0, Zone 1 (ATEX) Zone 0, Zone 1 (CENELEC, PTB, IEC)
Permissible ambient temperature on the housing	
- T6	-40°C ... +42°C
- T5	-40°C ... +58°C
- T4, T3	-40°C ... +60°C
Permissible ambient temperature on the transducer when used in Ex areas	
- T6	45°C
- T5	60°C
- T4	60°C
- T3	60°C

Process connections

VEGASON 51	G1 1/2 A, 1 1/2" NPT
VEGASON 52	G 2 A, 2" NPT
VEGASON 52	DN 100 compression flange or mounting loop

Connection cables

Power supply	supply and signal via one two-wire cable
Electrical connection	spring terminals (max. 2.5 mm²)
Cable entry	2 x M20 x 1.5 (cable diameter 5 ... 9 mm) or 2 x 1/2" NPT (cable diameter 3.6 ... 8.7 mm or 0.12 ... 0.34 inch)
Ground connection	max. 4 mm²

Materials

Housing	PBT (Valox) or Aluminium die casting (GD-AlSi 10 Mg)
Process connection	
- VEGASON 51, 52	PVDF (thread)
- VEGASON 53	PP or 1.4571 (compression flange) 1.4301 (mounting loop)
Transducer	
- VEGASON 51, 52	PVDF
- VEGASON 53	UP
Transducer diaphragm	
- VEGASON 51, 52	PVDF
- VEGASON 53	1.4571

Weights

VEGASON 51	1.2 kg
VEGASON 52	1.6 kg
VEGASON 53	2.3 kg

CE conformity CE

VEGASON 51 ... 53 ultrasonic sensors meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). Conformity has been judged acc. to the following standards:

EMC	Emission	EN 50 081 - 1: 1993
	Susceptibility	EN 50 082 - 2: 1995
NSR		EN 61 010 - 1: 1993
		EN 61 326 - 1: 1997/A1: 1998

3.2 Approvals

When using ultrasonic sensors in Ex areas or on ships, the instruments must be suitable and approved for the explosion zones and applications.
The suitability is checked by the approval authorities and is certified in approval documents.

Please note the attached approval documents when using a sensor in Ex area.

Test and approval authorities

- **PTB**
  (Physikalisch Technische Bundesanstalt - Physical Technical Approval Authority)
- **FM**
  (Factory Mutual Research)
- **ABS**
  (American Bureau of Shipping)
- **LRS**
  (Lloyds Register of Shipping)
- **GL**
  (German Lloyd)
- **CSA**
  (Canadian Standards Association)

3.3 Data format of the output signal

Byte4	Byte3	Byte2	Byte1	Byte0
Status	Meas. value (IEEE-754 format, see below)			

Status byte:
The status byte corresponds to the profile 3.0 "Profibus PA Profile for Process Control Devices" coded. The status "Meas. value OK" is coded as 80 (hex) (Bit7 = 1, Bit 6 ... 0 = 0).

Meas. value:
The meas. value is transferred as a 32 Bit floating point number in IEEE-754 format.

Byte n								Byte n+1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VZ	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
Sign	Exponent							Mantissa							

Byte n+2								Byte n+3							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Mantissa								Mantissa							

Formula: Meas. value = $(-1)^{VZ} \bullet 2^{(Exponent - 127)} \bullet (1 + Mantissa)$

Examples: 41 70 00 00 (hex) = 0100 0001 0111 0000 0000 0000 0000 0000 (bin)

Meas. value $= (-1)^{0} \bullet 2^{(130 - 127)} \bullet (1 + 2^{-1} + 2^{-2} + 2^{-3})$

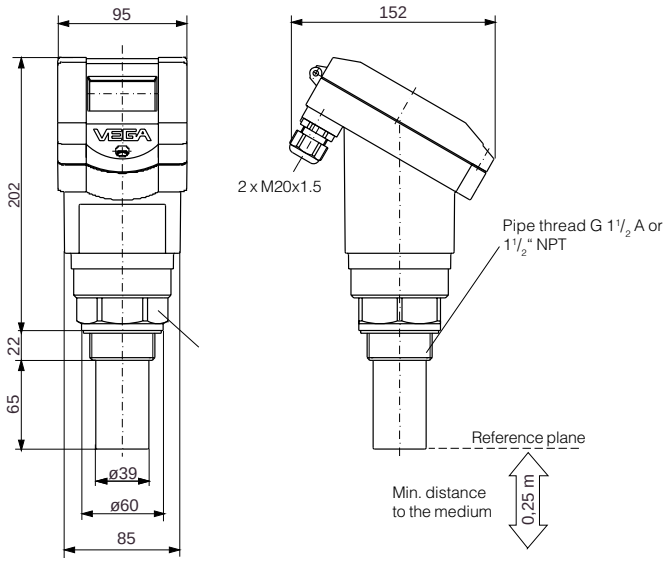
$= 1 \bullet 2^{3} \bullet (1 + 0.5 + 0.25 + 0.125)$

$= 1 \bullet 8 \bullet 1.875$

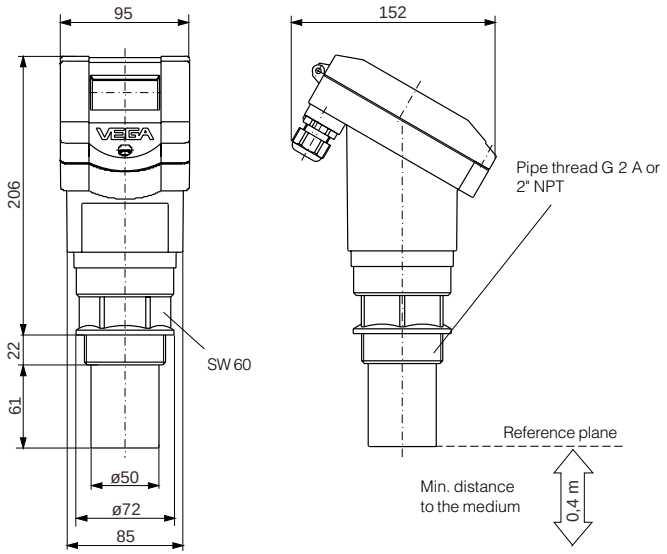
$= 15.0$

3.4 Dimensions

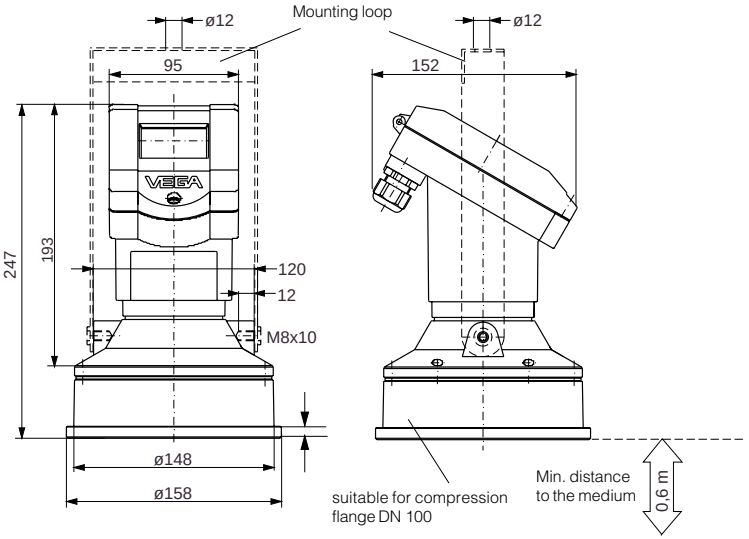
VEGASON 51



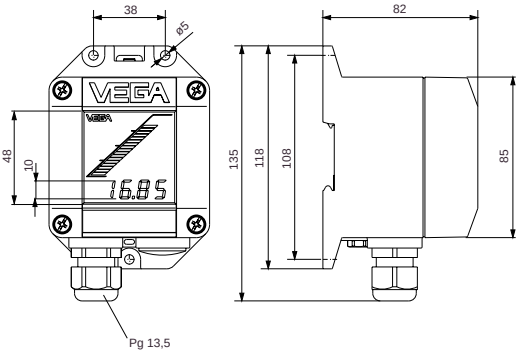
VEGASON 52



VEGASON 53



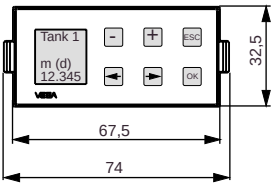
External indicating instrument VEGADIS 50



Note:
The diameter of the connection cable should be at least 5 mm and max. 9 mm. Otherwise the seal effect of the cable entry may not be ensured.

Mounting on carrier rail 35 x 7.5 acc. to EN 50 022 or flat screwed

Adjustment module MINICOM



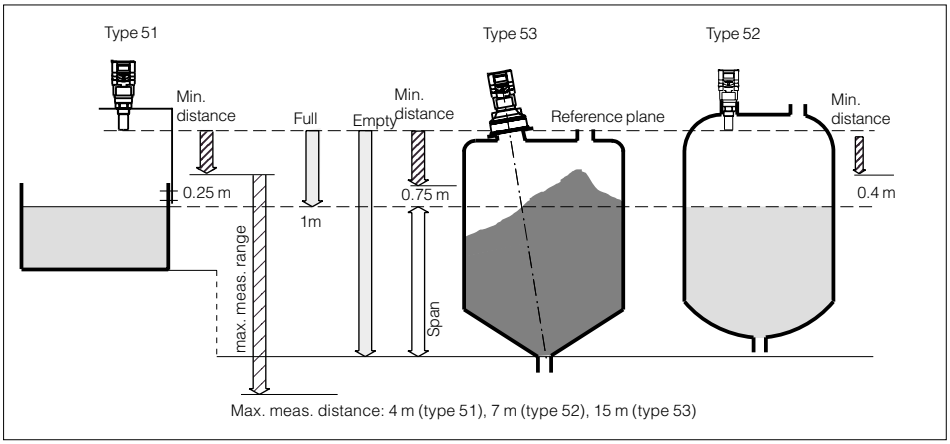
Adjustment module for insertion into series 50 sensors or into the external indicating instrument VEGADIS 50

4 Mounting and installation

4.1 General installation instructions

Measuring range

Beside other criteria, you select your instrument according to the required measuring range. The reference planes for the min. and max. distance to the liquid or solid is the transducer end or for instruments in flange version, the instrument flange. Please note the information on the reference plane in chapter "3.3 Dimensions". The max. filling depends on the required min. distance of the instrument used (0.25 m up to 0.75 m) and the mounting location of the instrument or the transducer.



Min. distance, max. measuring range and span (example VEGASON 51, 52 and 53)

Beam angle and false echoes

The ultrasonic impulses are focused by the transducers. The impulses leave the transducer in conical form similar to the beam pattern of a spotlight. The beam angle is 5.5° (VEGASON 51/5) or 3° (VEGASON 53) at -3 dB emitted power.

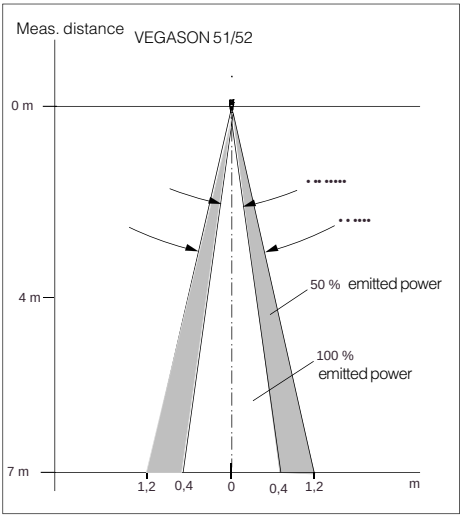
Any object, e.g. tubes or struts inside this emission cone will cause a large false echo. Especially within the first few meters of the emission cone, pipes, struts, or other installations can interfere with the measurement. At a distance of 6 m, the false echo of a strut has an amplitude nine times greater than at a distance of 18 m.

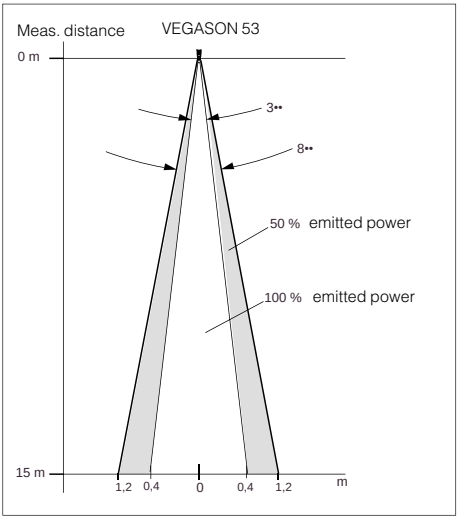
At greater distances, the energy of the ultrasonic impulses distributes over a large area, thus causing weaker echoes from obstructing surfaces. The interfering signals are therefore less critical than those at close range.

If possible, orient the sensor axis perpendicularly to the product surface and avoid vessel installations (e.g. pipes and struts) within the 100 % area of the emission cone.

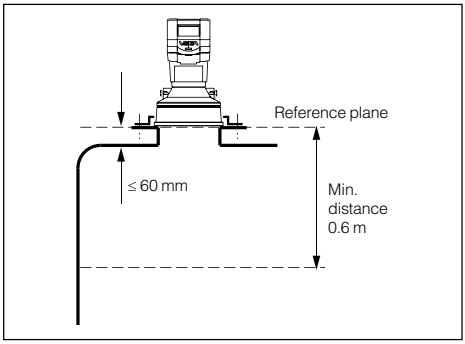
The following illustration of the ultrasonic beams is simplified and represents only the main beam - a number of additional weaker beams exists.

Therefore, in practical application, the transducer has to be oriented so that lowest possible false echo signal strength is achieved. Only giving attention to the size of the useful echo is usually not adequate under difficult measuring conditions. In most cases, a low false echo level enables the sensor to reliably pick up the useful echo. With the adjustment software VVO on the PC, you can view the echo image (see chapter "6.2 Adjustment with VVO – Sensor optimisation – Echo curve").



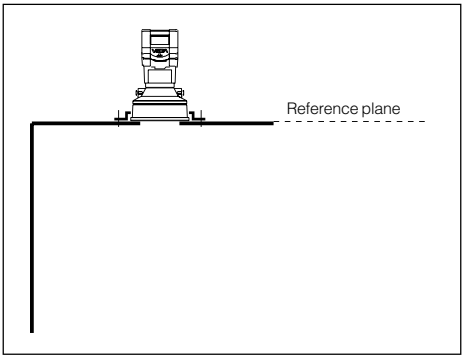


On flat vessels, mounting is usually done on a very short DIN socket piece. Reference plane for flange versions is the instrument flange. The transducer should protrude out of the flange tube.



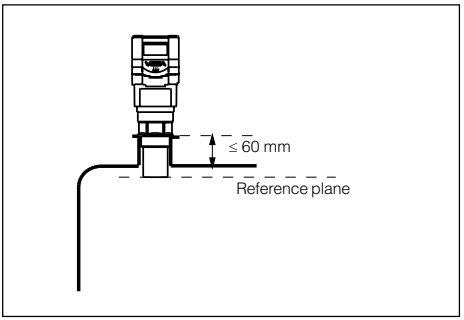
Flange version on very short DIN socket piece

A mounting location directly on the vessel top is ideal. A round opening in the vessel top is sufficient to fasten the VEGASON 53 sensor with a compression flange.



Flange version (compression flange) on flat vessel top

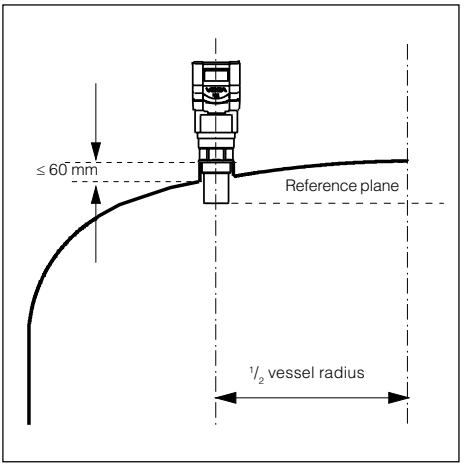
It is also possible to mount sensors with $1^1/_2$" or 2" thread to short socket pieces.



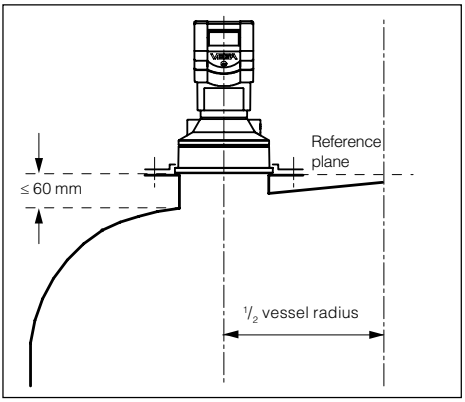
Mounting on short 1 1/2" or 2" socket piece

Dished tank ceiling

On dished tank ceilings, please do not mount the instrument in the centre, but approx. 1/2 vessel radius from the centre. Dished tank ceilings can act as paraboloidal reflectors. If the transducer is placed at the focal point of the parabolic ceiling, the transducer receives amplified false echoes. The transducer should be mounted outside the focal point. Amplified echoes caused by parabolic surfaces are thereby avoided.



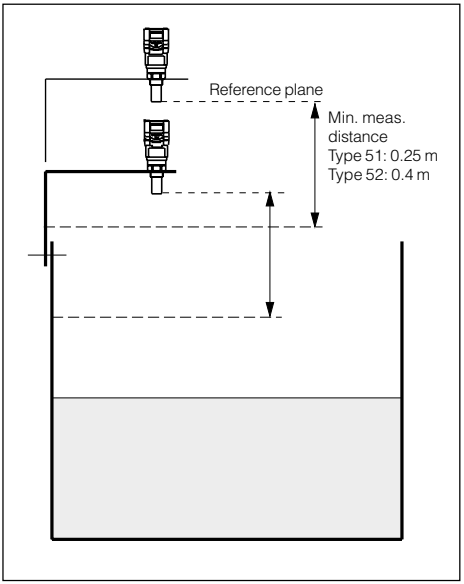
Mounting boss on dished tank ceiling



Flange on dished vessel ceiling

Open vessels

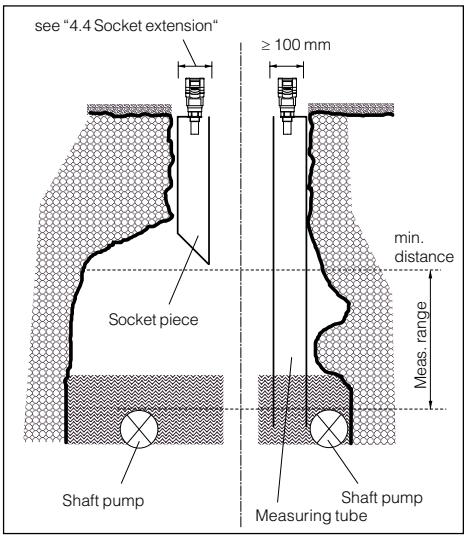
On open vessels, use of instruments on an extended mounting bracket is recommended. Mount the low-weight sensor onto such a bracket and ensure a sufficient distance from the vessel wall.



Open vessels

Pump shaft

Narrow, uneven shafts, wells and vessel openings with very rough walls and shoulders make ultrasonic measurement extremely difficult due to strong false echoes. This problem can be overcome by using an extended socket piece or a complete measuring tube (see chapter "4.5 Socket extension").



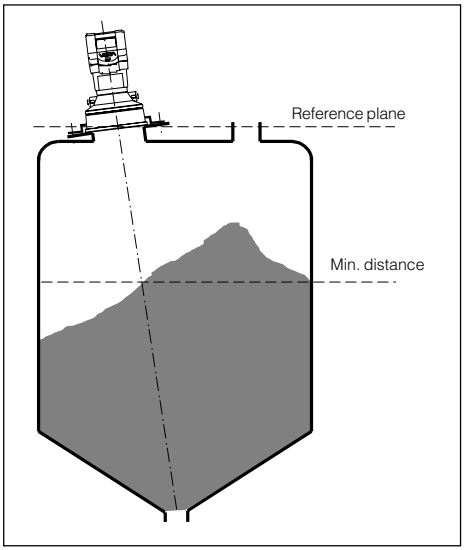
Example of a socket extension or measuring tube in a shaft

Very good measuring results can be attained with a measuring tube in continuous narrow shafts, see figure. The applied measuring tube must have smooth walls inside (e.g. PE sewage pipe) and a diameter ≥ 200 mm. This arrangement works well as long as the inside of the measuring tube collects no dirt or buildup (cleaning necessary). You might want to consider using hydrostatic pressure transmitters or capacitive measuring probes. Either the measuring tube should never be immersed in the medium, or it must always be immersed, so that the measurement is carried out exclusively in the tube.

4.3 Measurement of solids

Flange mounting

As with applications for liquids, the instrument can be mounted on a short DIN socket connection on vessels for solids. The transducer axis should only point to the vessel outlet or should be directed perpendicular to the product surface and must be very short (< 100 mm).

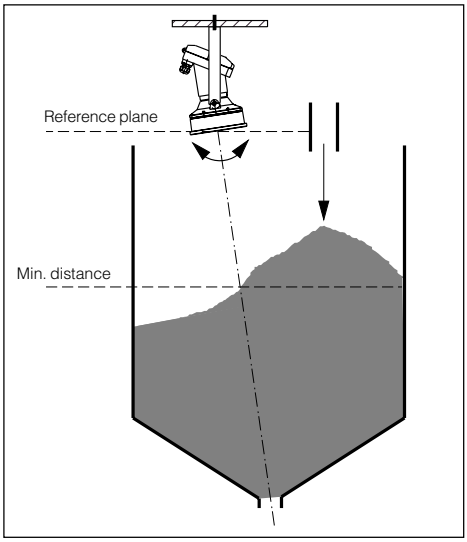


VEGASON 53 on vessel flange

Swivelling holder

A swivelling holder enables not only correct orientation to the product surface but also minimisation of possible false echoes.

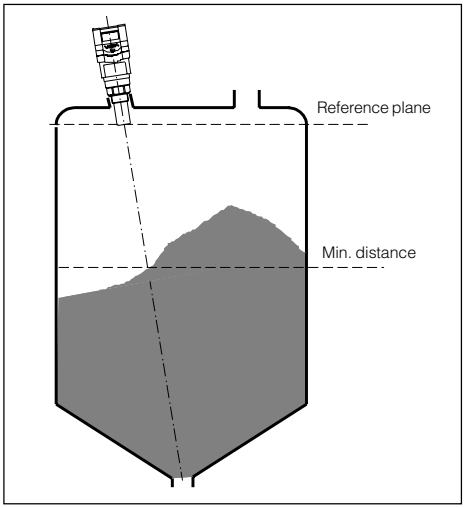
Our line of accessories contains a swivelling holder (mounting loop) for mounting VEGASON 53. It enables optimum orientation of the sensor to the product surface.



VEGASON 53 on swivelling holder

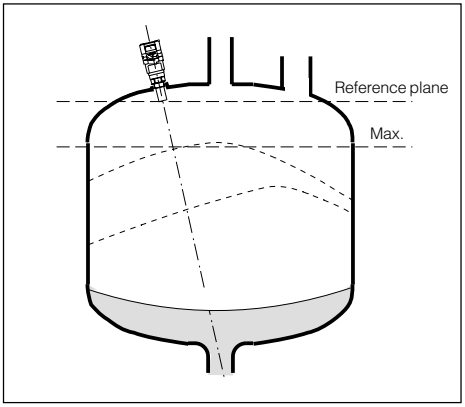
Mounting boss

For threaded process connections (type 51, 52), the mounting boss should be short enough to allow the transducer end to protrude from the boss. This will prevent if from interfering with the ultrasonic signals.



VEGASON 51 or 52 on the mounting boss. The socket axis should be directed to the product surface.

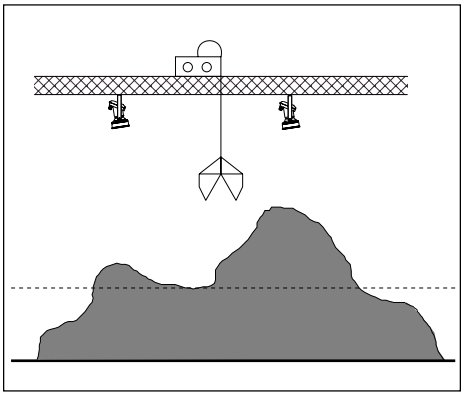
Different filling conditions often lead to a varying product surface orientation. This causes the useful echo to vary in quality. For this reason, the transducer should be mounted in such a way that, even in the empty vessel, the false echo intensity is as low as possible. You can view the echo curve on the PC with the adjustment program VVO (see chapter "6 Setup/Adjustment with the PC/Sensor optimisation/Echo curve").



VEGASON 52 on mounting boss

Material heaps

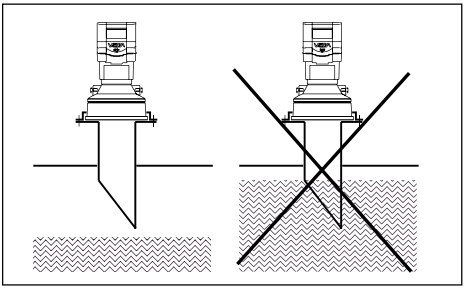
Large material heaps are usually measured with several instruments, which can be mounted on e.g. traverse cranes.



Transducer on traverse crane above a material heap

Ultrasonic sensors require a min. distance to the product or solid. Take the min. distance into account in your planning. In some situations, it is possible to reach the required min. distance, and hence the desired filling height, with a socket extension. However, the socket extension increases the noise level of the ultrasonic signal at the extension outlet and can interfere with the measurement. Only use a socket extension if all other possibilities have to be excluded. Carry out the extension as shown in the following illustration.

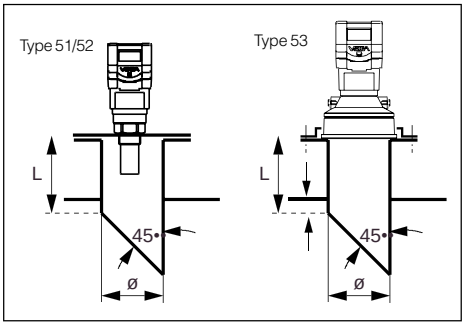
Chamfer and deburr the socket carefully and make sure it has a smooth inner surface. The socket should not protrude into the measured product, in case buildup can form on the socket through pollution or product residues.



Socket piece should not be immersed into adhesive products (figure: VEGASON 53)

The socket diameter should be as large and the socket length as small as possible. To minimise false echoes, make sure that the socket outlet is burr-free.

For nonadhesive measured products, a socket extension in the form of a measuring tube can be permanently submerged in the product. The ultrasonic measurement is then made exclusively in the measuring tube and works very well without interference from other vessel installations (see page 26 "Pump shaft").

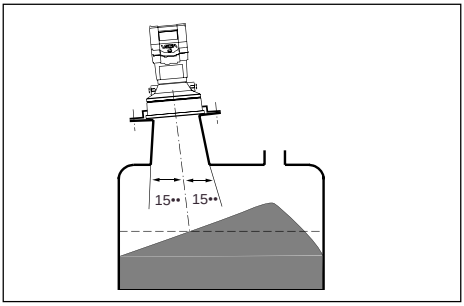


Socket extension in liquids

Max. socket length in relation to socket diameter

ø	L in mm		
in mm	Type 51	Type 52	Type 53
100	200	300	300
150	300	400	400
200	–	500	500
250	–	–	600

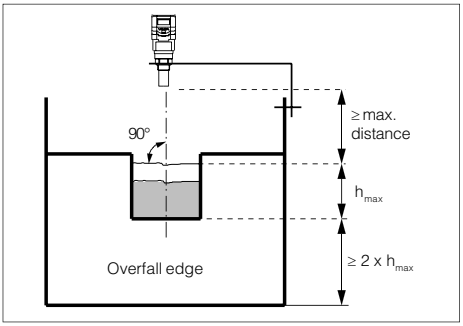
For solids, use a conical socket extension with a taper of at least 15° … 20°.



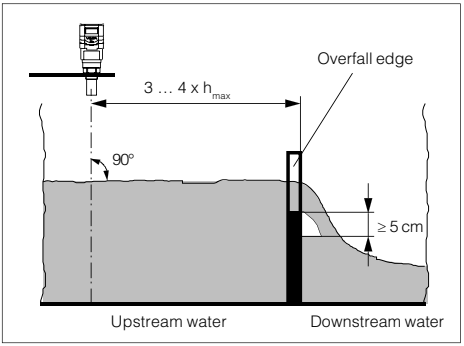
Socket extension in solids

The short examples on this page are only basic information on flow measurement. You can get complete planning information from the flume manufacturers and in special literature.

- Installation of the sensor on the upstream side
- Note distance to the overfall edge (3 … 4 x h_{max})
- Installation centered to the flume
- Edge opening ≥ 2 x h_{max} from ground
- Installation perpendicular to the liquid surface
- Keep min. distance in relation to h_{max}
- Min. distance from edge opening to downstream water ≥ 50 mm

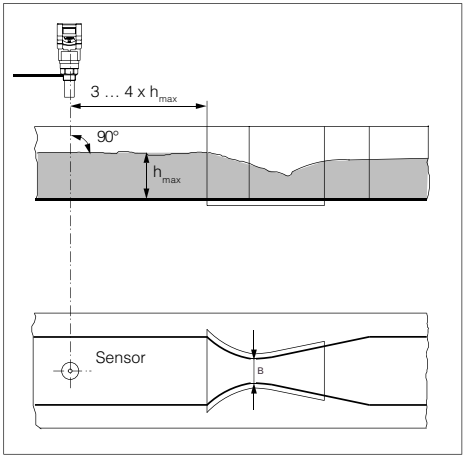


Flow measurement on open flumes



Flow measurement on open flumes

- Installation of the sensor on the inlet side
- Note distance to the Khafagi-Venturi flume (3 … 4 x h_{max})
- Installation perpendicular to the liquid surface
- Keep min. distance in relation to the height of damming h_{max}



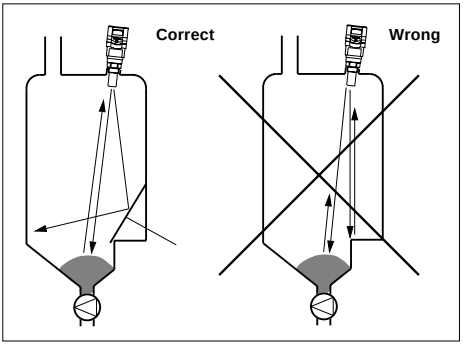
Khafagi-Venturi flume

4.6 False echoes

The mounting location of the ultrasonic sensor must be selected such that no installations or inflowing material are in the path of the ultrasonic impulses. The following examples and instructions show the most frequent measuring problems and how to avoid them.

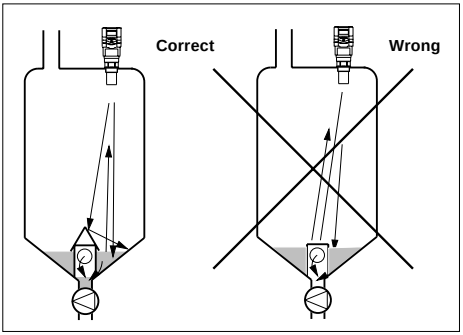
Vessel protrusions

Vessel forms with flat protrusions can, due to their strong false echoes, adversely effect the measurement. Shields above these flat protrusions scatter the false echoes and guarantee a reliable measurement.



Vessel protrusions (slope)

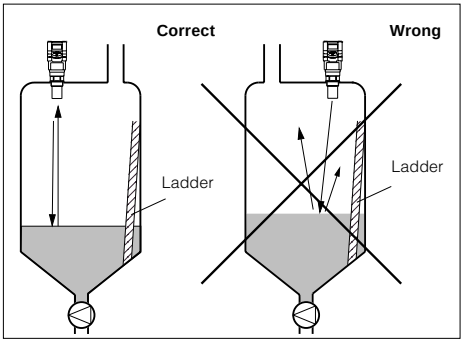
Intake pipes, e.g. for the mixing of materials - with a flat surface directed towards the sensor - should be covered with a sloping shield. This shield will scatter false echoes.



Vessel protrusions (intake pipe)

Vessel installations

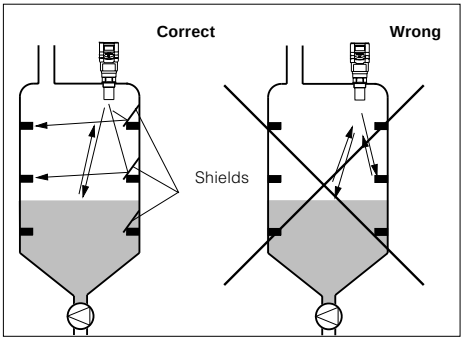
Vessel installations such as, for example, a ladder, often cause false echoes. Make sure when planning your measurement loop that the ultrasonic signals have free access to the measured product.



Vessel installations

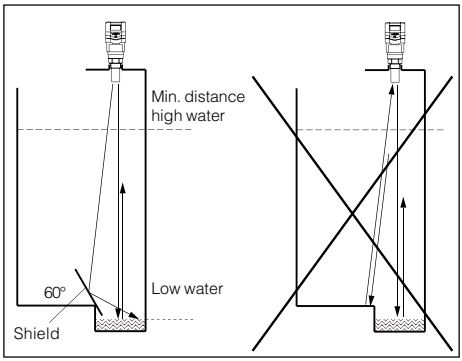
Struts

Struts, like other vessel installations, can cause strong false echoes that are superimposed over the useful echo signals. Small shields effectively hinder a direct false echo reflection. These false echoes are scattered and diffused in the area and are then filtered out as "echo noise“ by the measuring electronics.



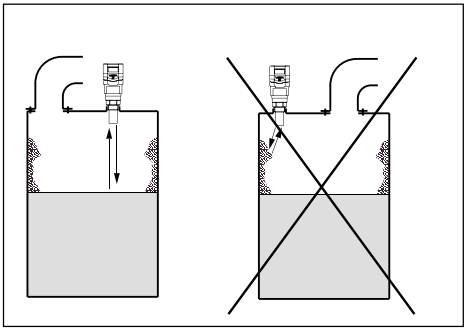
Struts

The expected max. high water determines the installation height, to ensure the min. distance of the transducer even with the highest water level. The low water basin ledges should be covered with a shield in the transducer area to filter out echoes from exposed basin surfaces.



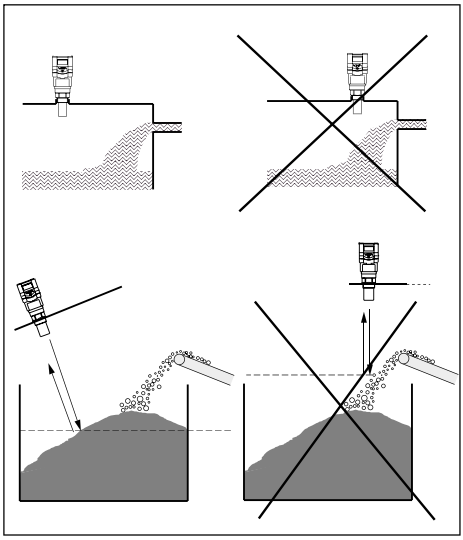
Filtering out of a ledge echo

If the sensor is mounted too close to the vessel wall, buildup and adhesions of the measured product to the vessel wall can cause false echoes. Position the sensor at a sufficient distance from the vessel wall. Please also note chapter "4.1 General installation instructions".



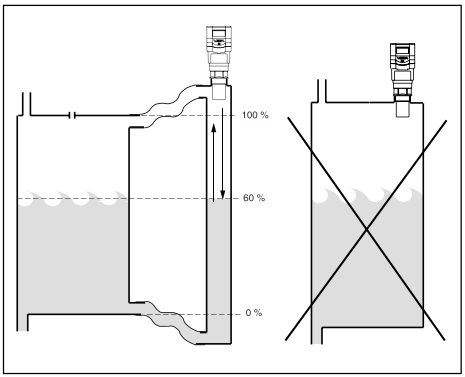
Buildup

Do not mount the instrument in or above the filling stream. Ensure that you detect the product surface and not the inflowing material.



Inflowing material

Strong turbulence in the vessel, e.g. by powerful stirrers or intense chemical reactions, seriously interfere with the measurement. A surge or bypass tube (illustration) of sufficient size always allows, provided the product causes no buildup in the tube, a reliable measurement even with strong turbulence in the vessel.

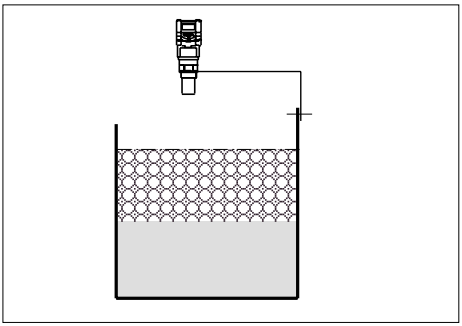


Strong turbulence

4.7 Incorrect mounting

Foam generation

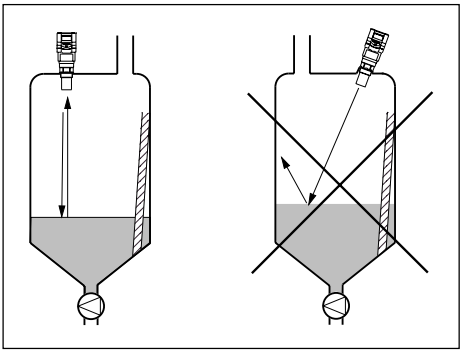
Thick foam on the product can cause incorrect measurements. Take measures to avoid foam, carry out the measurement in a bypass tube, or use a different measuring technology, e.g. capacitive measuring probes or hydrostatic pressure transmitters.



Foam generation

Wrong orientation to the product

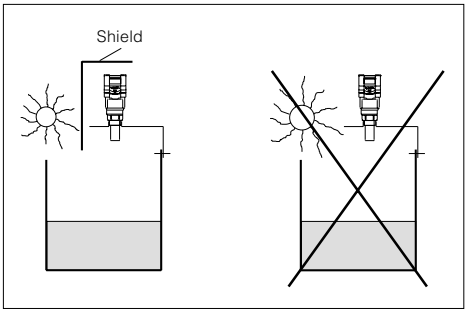
Weak measuring signals are the result if the sensor is not directly pointed at the product surface. Orient the sensor axis perpendicularly to the product surface to achieve optimum measuring results.



Orient the sensor perpendicularly to the product surface

Strong heat fluctuations

Strong heat fluctuations, e.g. due to the sun, cause measuring errors. Please provide a sun shield.

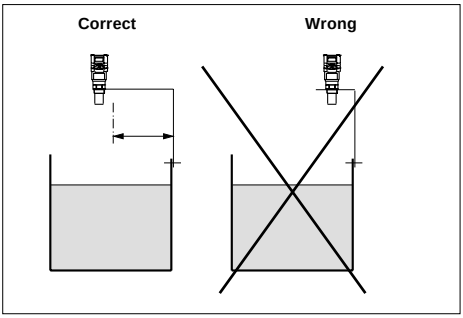


Strong heat fluctuations

Min. distance to the medium

If the min. distance to the medium is not maintained, the instruments show wrong measured values. Mount the instrument at the required min. distance.

Sensor too close to the vessel wall

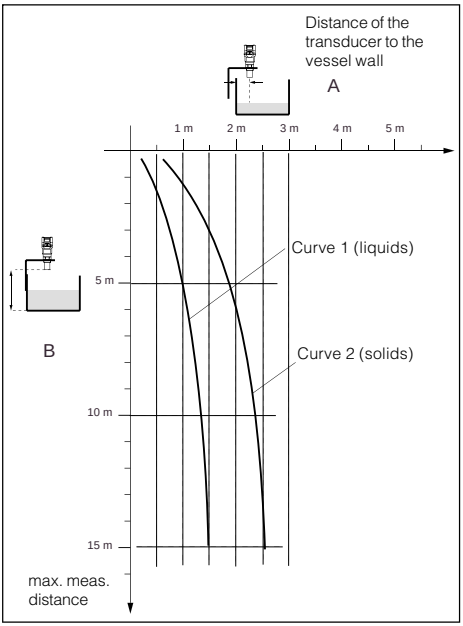


Sensor too close to the vessel wall

If the sensor is mounted too close to the vessel wall (dimension A in diagram), strong false echoes can be caused. Buildup, rivets, screws or weld joints on the vessel wall superimpose their echoes to the product or useful echo. Please ensure the sufficient distance of the sensor to the vessel wall, depending on the maximum measuring distance (dimension B in diagram).

In case of good reflection conditions (liquids, no vessel installations), we recommend determining the sensor distance according to . At a max. meas. distance of e.g. 10 m, the distance of the transducer (according to curve 1) should be approx. 1.5 m.

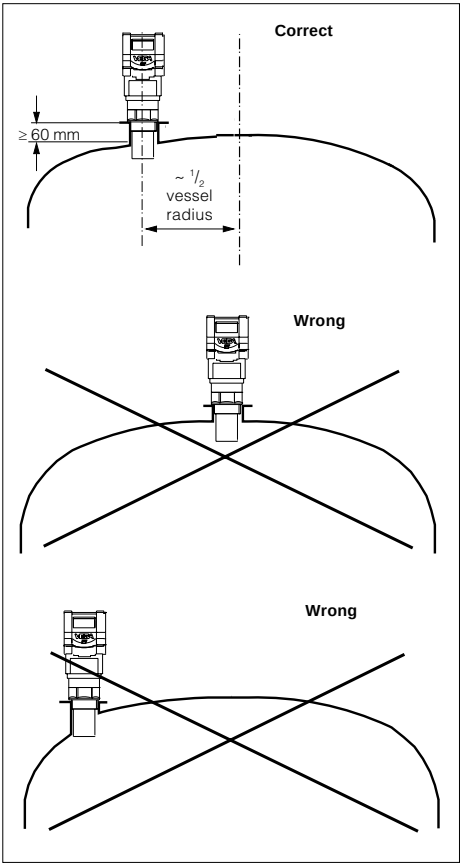
In case of solids with poor reflective properties, determine the distance to the vessel wall according to . Under very bad measuring conditions (rough vessel walls, struts), it might be necessary to increase the distance to the vessel wall, or to also filter out the false echoes by storing them in memory, thereby adapting the sensor more precisely to the environment.



Distance of the sensor from the vessel wall depending on the measuring distance (type 51 … 53)

Parabolic effects of rounded or arched vessel tops

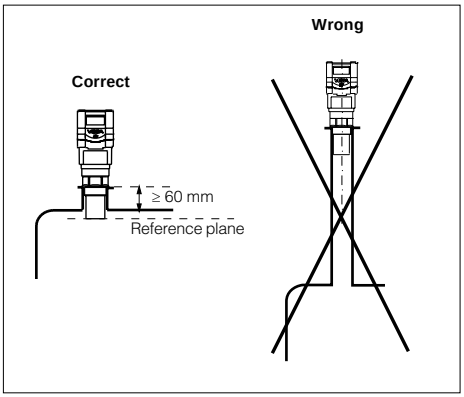
Round or parabolic tank tops act like a parabolic mirror on the signals. If the sensor is placed at the focal point of such a parabolic tank top, the sensor receives amplified false echoes. The optimum location is generally in the area of half the vessel radius from the centre.



Mounting on a vessel with parabolic tank top

Socket piece too long

If the sensor is mounted in a socket extension that is too long, strong false echoes are caused, and measurement is hindered. Make sure that the transducer protrudes at least 30 mm out of the socket piece.



Correct and wrong length of socket piece

5 Electrical connection

5.1 Connection – Connection cable – Screening

Safety information – Qualified personnel

Instruments which are not operated with protective low voltage or DC voltage must only be connected by qualified personnel. This is also valid for the configuration of measuring systems planned for Ex environment.

As a rule, do all connecting work in the complete absence of line voltage. Always switch off the power supply before you carry out connecting work on the radar sensors. Protect yourself and the instruments.

Connection cables and bus configuration

Note the Profibus specification. The connection cables must be specified for the expected operating temperatures in the plant and must have an outer diameter of 6 … 12 mm, to ensure the seal effect of the cable entry on the sensor.

For power supply and bus communication, a two-wire cable acc. to the Profibus specification (up to max. 2.5 mm^2 conductor cross-section) can be used. The electrical connection on the sensor is made by means of spring-loaded terminals.

In a laboratory setup, a Profibus system will also work with standard, unshielded two-wire cable. In practice however, an automation network and bus system can only be protected reliably against electromagnetic interference with screened cable. Acc. to the Profibus specification (IEC 1158-2) screened and twisted cables are prescribed.

All participants are connected in line (serially). At the beginning and end of the bus segment, the bus is terminated by an active bus termination. On the DP bus level, most participants already have a bus termination implemented. With more than 32 participants on the DP level, a so-called repeater must be used to open and combine another DP level with a max. of 32 participants. On the PA bus branch of the segment coupler, the PA ultrasonic sensors work also with max. 32 participants (Ex max. 10 participants).

A PA sensor can work only in conjunction with a Profibus DP system, to which a Profibus PA subsystem is connected. A PA Profibus participant must consume min. 10 mA supply current.

Connection cable and cable length

Connection cables must correspond to the Profibus specification and the FISCO model. The sensor cable must be in conformity with the values of the reference cable acc. to IEC 1158-2:
0.8 mm^2; $R_{DCmax.}$ = 44 Ω/km;
$Z_{31.25kHz}$ = 80 … 120 Ω; damping = 3 dB/km;
$C_{asymmetric}$ = 2 nF/km.

The max. cable length first of all depends on the transmission speed:
up to 32 kbit/s: 1900 m Profibus PA
up to 94 kbit/s: 1200 m Profibus DP
up to 188 kbit/s: 1000 m Profibus DP
up to 500 kbit/s: 500 m Profibus DP
up to 1500 kbit/s: 200 m Profibus DP
up to 12000 kbit/s: 100 m Profibus DP

The distributed resistance of the cable, in conjunction with the output voltage of the segment coupler and the current requirement (VEGASON 10 mA) or the voltage requirement (VEGASON 9 V) of the sensor, determines the max. length of the cable.

In practical application of a PA bus branch, the max. length of the cable is also determined (beside the required supply voltage and max. current consumption of all participants on the PA bus branch) by the bus structure and the type of segment coupler used.

The cable length results from the sum of all cable sections and the lengths of all stubs. The length of the individual stubs must not exceed the following lengths:

1 … 12 stubs	120 m (Ex: 30 m)
13 … 18 stubs	60 m (Ex: 30 m)
19 … 24 stubs	30 m (Ex: 30 m)

No more than 24 stubs are permitted, whereby each branch longer than 1.2 m is counted as a stub. The total length of the cable must not exceed 1900 m (in Ex version 1000 m).

Ground terminal

The electronics housings of the sensors have a protective insulation. The ground terminal in the electronics is galvanically connected with the metallic process connection. For sensors with a plastic thread as process fitting, the sensor grounding must be made by a ground connection to the outer ground terminal.

Screening

"Electromagnetic pollution“ caused by electronic actuators, energy cables and transmitting systems has become so pervasive that shielding for the two-wire bus cable is usually a necessity. According to the Profibus specification the screening should be made on both ends. To avoid potential equalisation currents, a potential equalisation system must be provided in addition to the screening.

According to specification, we recommend the use of twisted and screened two-wire cable, e.g.: SINEC 6XV1 830-5AH10 (Siemens), SINEC L26XV1 830-35H10 (Siemens), 3079A (Belden).

Alternatively, when grounding at both ends in non-Ex areas, the cable shielding can be connected on one ground side (in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 V) to the ground potential. Make sure that the ground connection has the lowest possible resistance (foundation, plate or mains earth).

Profibus PA in Ex environment

When used in Ex area, a PA bus with all connected instruments must be carried out in intrinsically safe protective class "i“. Four-wire instruments requiring a separate supply must at least have an intrinsically safe PA connection. VEGA sensors for PA-Ex environment are generally "ia” two-wire instruments“.

In the so-called Fieldbus Intrinsically Safe Concept (FISCO) the general conditions for an Ex safe bus configuration have been laid down. Therein, the participants and the bus cables with their respective elec. data have been determined, so that the linking of these components always meets the Ex requirements. The more time-consuming Ex calculation normally required is therefore not necessary. Build your Ex bus according to the IEC standard 1158-2.

The Ex segment coupler delivers a controlled power supply to the PA bus. All other components (field instruments and bus terminators) are only consumers. A field instrument must consume at least 10 mA. Ideally, an individual sensor should not consume more than 10 mA so that the number of instruments can be as large as possible.

VEGA PA sensors, whether Ex or non Ex, consume a constant current of 10 mA. According to the Profibus specification, this is the minimum participant current. With VEGA sensors it is therefore possible to connect 10 sensors (also in Ex environment) even with a limited energy supply from the Ex segment couplers.

Watch out for potential losses

Due to potential losses, earthing on both sides without potential equalisation system is not allowed in Ex applications. If an instrument is used in hazardous areas, the required regulations, conformity and type approval certificates for systems in Ex areas must be noted (e.g. DIN 0165). Please also note the approval documents with the safety data sheet attached to the Ex sensors.

Electrical data of the cables

	R_{DC}	No. of cores	A in mm^2	$Z_{31.25kHz}$	C in nF/km	Damping	Screen
SINEC 6XV1 830-5AH10 (Siemens)	44 Ω/km	2	0.75	100 Ω +/- 20 Ω	< 90	< 3 dB/km 39 kHz	Cu-braiding
SINEC L26XV1 830-35H10 (Siemens)	44 Ω/km	2	0.75	100 Ω +/- 20 Ω	< 90	< 3 dB/km 39 kHz	Cu-braiding
3079A (Belden)	105 Ω/km	2	0.32	150 Ω	29.5	< 3 dB/km 39 kHz	foil

5.2 Sensor address

In a Profibus system composed of Profibus DP and Profibus PA subsystem, each participant must have a unique address. Each participant, whether master or slave, is accessed by means of its own address in the bus system. The address of a participant, whether on DP or PA level, should be assigned before connecting to the bus, because an address can be used only once. If an address is used twice, interference will be caused in the bus.

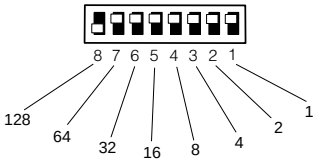
The address of an ultrasonic sensor can be set in two ways:
- with the adjustment software VVO (software addressing) or
- with the DIP switch block in the sensor (hardware addressing).

VEGA Profibus sensors are dispatched with the address set at 126 (all DIP switches to "ON").
Remember, in a Profibus system there are max. 126 participants possible. When the DIP switch is set to address 126 (or higher), the address can be adjusted with the adjustment software VVO, the adjustment module MINICOM or another configuration tool (e.g. PDM). However, there can be only one sensor on the bus with address 126 (delivery status) during address assignment via software. For that reason, hardware addressing (DIP switch) before connection to the bus is recommended.

Hardware addressing

The DIP switches generate an address number in the binary system. This means that, from right to left (ascending), any switch represents a number twice as high as the previous switch on the right. The corresponding number in the decimal system results from the sum of all switches set to "ON". In the illustration you see the decimal number that corresponds to each individual DIP switch.

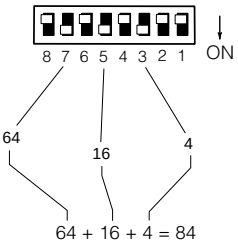
DIP switch 8 corresponds to the number 128, switch 1 corresponds to the number 1 and switch 3 corresponds to the decimal number 4.



Example 1

The switches 3, 5 and 7 are set to "ON". The address is then:
DIP switch 3 to "ON" means 4
DIP switch 5 to "ON" means 16
DIP switch 7 to "ON" means 64

4 + 16 + 64 = Address 84



Example 2

You want to set address 27.
16 + 8 + 2 + 1 = 27

You must set the DIP switches
5 = 16
4 = 8
2 = 2
1 = 1
to "ON".

Example 3

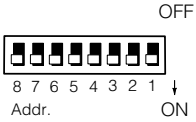
You want to set address 99
64 + 32 + 2 + 1 = 99

You must set the DIP switches
7 = 64
6 = 32
2 = 2
1 = 1
to "ON".

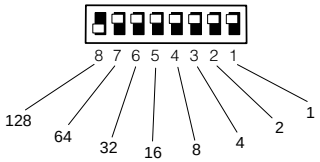
Software addressing

The DIP switches must be set to an address of 126 ... 255, i.e.

- either all DIP switches are set to "ON", corresponding to address 255 (delivery status)
- or only DIP switch 8 is set to "ON", corresponding to address 128.



Of course, software addressing is also possible if the switches 7 ... 2 are set to "ON" (address 126).



Address assignment via software VVO is described in chapter "6.2 Adjustment with VVO" under the heading "Software addressing" or in chapter "6.3 Sensor adjustment with the adjustment module MINICOM".

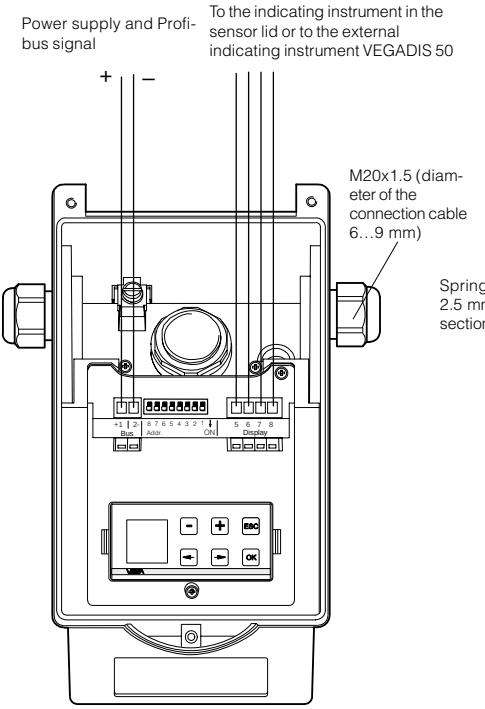
5.3 Connection of the sensor

After mounting the sensor at the measurement location according to the instructions in chapter "4 Mounting and installation", loosen the closing screws on top of the sensor. The sensor lid with the optional indication display can then be opened. Unscrew the sleeve nut and slip it over the connection cable (after removing about 10 cm of insulation). The sleeve nut of the cable entry has a self-locking ratchet that prevents it from opening on its own.

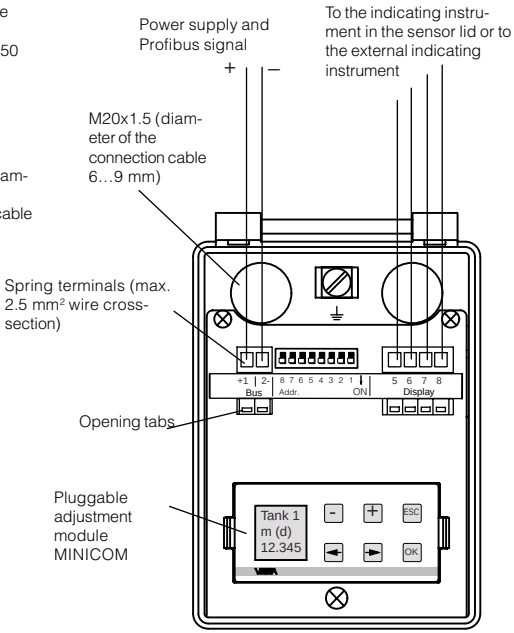
Now insert the cable through the cable entry into the sensor. Screw the sleeve nut back onto the cable entry and clamp the stripped wires of the cable into the proper terminal positions.

The terminals hold the wire without a screw (spring terminals). Press the white opening tabs with a small screwdriver and insert the copper core of the connection cable into the terminal opening. Check the hold of the individual wires in the terminals by lightly pulling on them.

Version with Aluminium housing

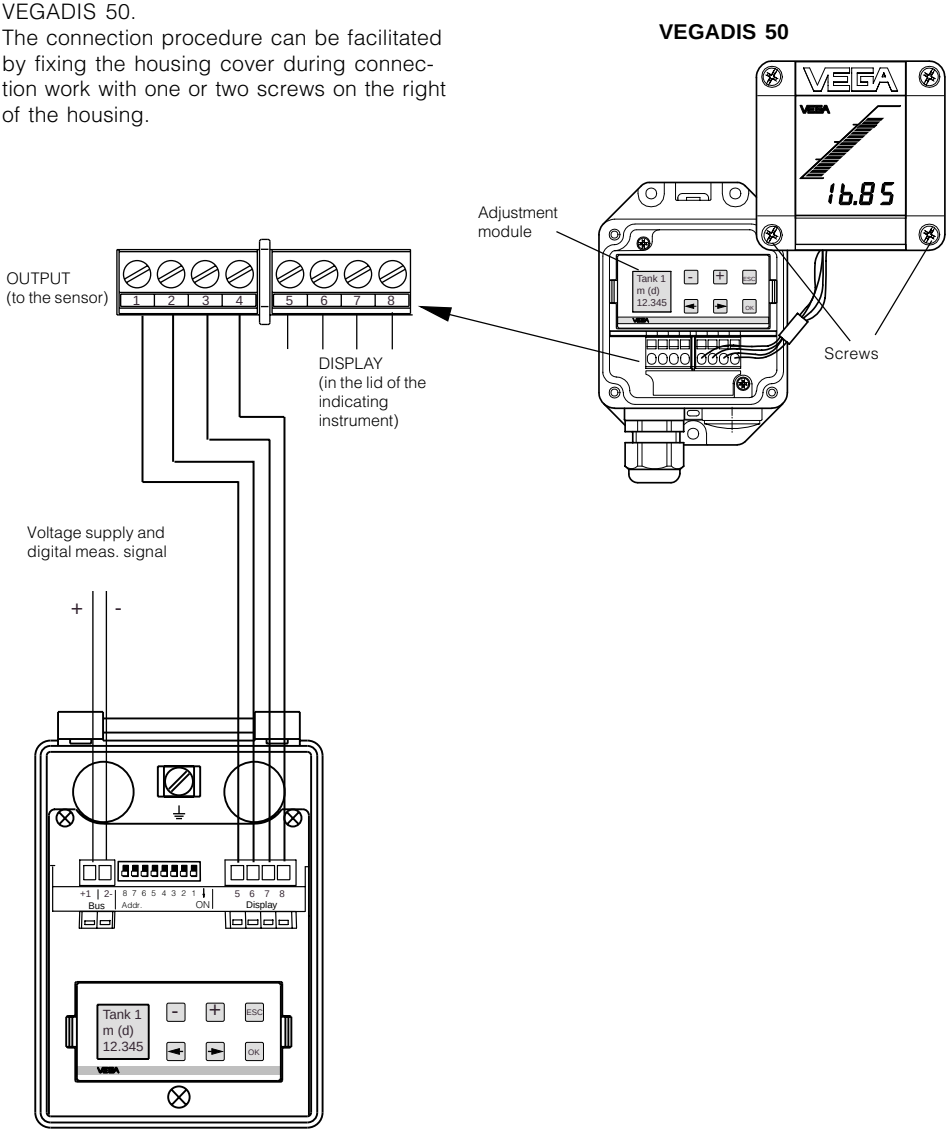


Version with plastic housing



5.4 Connection of the external indicating instrument

Loosen the four screws of the housing lid on VEGADIS 50.
The connection procedure can be facilitated by fixing the housing cover during connection work with one or two screws on the right of the housing.



6 Setup

6.1 Adjustment media

In chapter "1.4 Adjustment" the Profibus adjustment structure was briefly explained and the adjustment media for VEGA Profibus sensors were shown. All VEGA Profibus sensors operate in profile 3 and can be adjusted with:

- the adjustment program VVO on a PC with Profibus card
- the adjustment program PACTware™, in which VVO runs as a subprogram
- the Siemens software PDM in conjunction with an EDD (Electronic-Device-Description)
- the adjustment module MINICOM in the sensor.

Adjustment with VVO on the PC

The adjustment program VVO enables user-friendly adjustment of VEGA Profibus PA sensors. All functions and options of sensor adjustment are possible. The program runs under Windows® on a PC with a Profibus-Master-Class 2 interface card on Profibus DP level as Master-Class 2 tool. The VVO program accesses the VEGA PA sensors via the DP bus, the segment coupler and the PA bus.

Adjustment with PACTware™ 1)

The adjustment with PACTware™ corresponds to VVO adjustment, however in this case, VVO runs as a subprogram of PACTware™. The adjustment instructions can be found in the documentation of PACTware™.

Adjustment with PDM

The sensors can be adjusted completely with PDM. However, some user-friendly functions and many special features, like e.g. display of an echo curve, are not available. In addition to the PDM software, an EDD (upon request available from VEGA) is required for each sensor type. The adjustment instructions for PDM are described in the PDM documentation.

Adjustment with the adjustment module MINICOM

With the adjustment module MINICOM, you adjust the individual sensor directly on the sensor or in the external indicating instrument VEGADIS 50. The adjustment module MINICOM enables (with the 6 key adjustment field with text display) all essential functions for parameter setting and adjustment.

1) presumably available until end of 2000

6.2 Adjustment with VVO

Before you can adjust the sensors with the adjustment program VVO (VEGA Visual Operating), they must be integrated into the Profibus system. First of all address the sensors (chapter "5.2 Sensor address") and connect them to your PA segment. With the attached GSD file you integrate the sensors into your system.

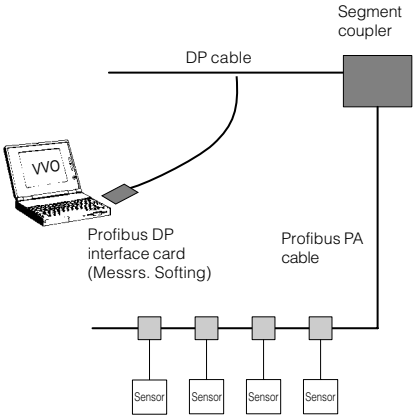
To adjust the VEGA sensors with the adjustment software VVO, the PC or the adjustment station on which VVO is installed must be equipped with a Profibus DP interface card (e.g. of Messrs. Softing). The PC or the adjustment station communicates then as Master-Class 2 participant on the DP bus with the VEGA sensors on the PA bus segment.

To connect the PC to the DP bus, a standard RS 485-DTE interface cable (Data Terminal equipment) is required. With the cable you connect the DP interface card to the bus or to the segment coupler.

PC		BUS		
Screen	1	1	Screen	
– –	2	2	M24	
RxD/TxD-P	3	3	RxD/TxD-P	(40)
– –	4	4	CNTR-P	
GND	5	5	GND	(55)
– –	6	6	VP	
– –	7	7	P24	
RxD/TxD-N	8	8	RxD/TxD-N	(41)
– –	9	9	CNTR-P	

Profibus-DP interface card

DP bus (in brackets the PIN number of the P+F segment couplers)



If the computer is connected to the Profibus DP cable, you can start VVO.

In the following setup and adjustment instructions you will find information on the following topics and adjustment items:

- Configuration
  - Configuration info
  - Software addressing
  - Create new measurement loop
- Parameter adjustment 1
  - Meas. loop data
  - Adjustment
  - Scaling
- Sensor optimisation
  - Meas. environment/Operating range
  - Meas. environment/Meas. conditions
  - Meas. environment/Sonic velocity
  - Echo curve
  - False echo storage
- Parameter adjustment 2 (optional)
  - Linearisation
  - Defining the linearisation curve by incremental filling
  - Calculating the linearisation curve
  - Calculate cylindrical tank
- Display measured value
- Simulation
- Print configuration and adjustments
- Backup

Configuration and parameter adjustment

During setup of the sensor you will be confronted with two terms: "Configuration" and "Parameter adjustment". The measuring system is first configured and then made ready for operation by parameter adjustment.

Configuration

The term "Configuration" means the basic adjustments of the meas. system. You inform the meas. system about the application (level measurement, gauge, distance ...), the measurement loop name and the DCS output address of the sensors. The configuration corresponds to an electronic wiring and labelling of your sensor or, in other words, telling the system which sensor for what application and where.

Parameter adjustment

After the configuration, you carry out the parameter adjustment on each individual sensor. This means adjusting the sensors to the respective operating range and adapting them to the specific application. You inform the sensor which product distance (which level) is "empty" and which "full". This is called adjustment. Here you choose in which physical unit (volume, mass) and unit of measurement (m^3, gal, liters ...) the adjusted measured value should be outputted. In the submenu "Sensor optimisation" you inform the sensor electronics about the actual environment, such as e.g. quick changes of the measured value, foam generation, gas stratification, solid or liquid.

Before starting the setup:

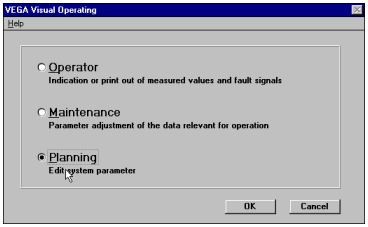
Do not be confused by the many pictures, adjustment steps and menus on the following pages. Just carry out the setup with the PC step by step and you will soon no longer need the following pages.

Action, like entering a value or making a choice, are indicated in the following by a large black dot, like this:

- Choose ...
- Start ...
- Click to ...

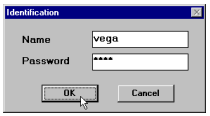
By this convention, the actions to be carried out are clearly separated from supplementary information in the following adjustment instructions.

- Now start the adjustment software VVO on your PC.



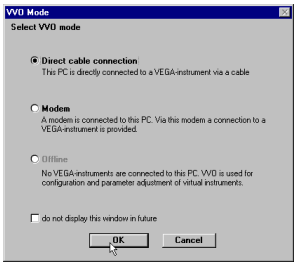
- Choose with the arrow keys or the mouse the item "Planning" on the entrance screen and click to "*OK*".

You are asked for user identification.



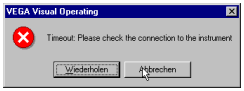
- Enter under name "VEGA".
- Also enter "VEGA" under password.

The adjustment program VEGA Visual Operating (VVO), called in the following VVO, gets into contact with the connected sensor …

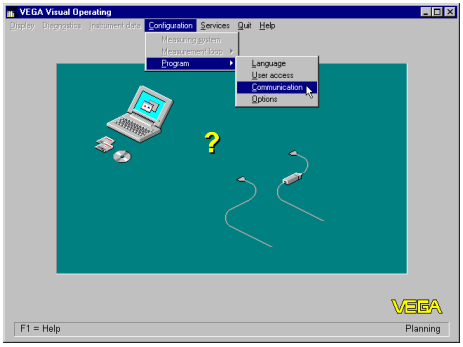

VVO Mode
Select VVO mode
Direct cable connection
This PC is directly connected to a VEGA-instrument via a cable
Modem
A modem is connected to this PC. Via this modem a connection to a VEGA-instrument is provided.
Offline
No VEGA-instruments are connected to this PC. VVO is used for configuration and parameter adjustment of virtual instruments.
do not display this window in future
OK
Cancel

… and asks in which mode the adjustment software should be used. After a few seconds, the software indicates if and with which system a connection exists.

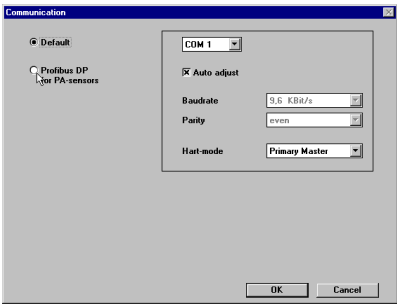
If the following message is displayed, you have to change the communication settings in VVO.

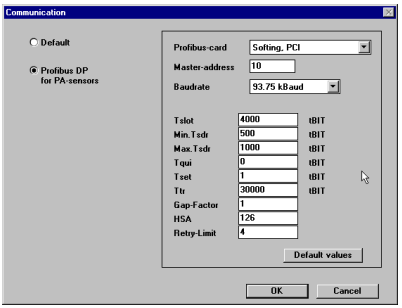


- Then click to "*Configuration*", point to "*Program*" and click to "*Communication*".



- First click to "*Profibus DP (for PA sensors*". Then choose the Profibus card which is installed in your PC.

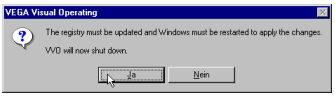




The window for the bus communication adjustments opens. Ten is preadjusted as address for the Master-Class 2 interface card. If participant number 10 is free in your bus, you can accept address 10. Typical values of the bus parameters have been preset. At this point, you should adjust the communication parameters that apply to your system.

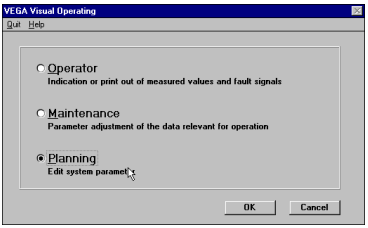
- Now click to "*OK*".

The message "*VVO will shut down and Windows® must be restarted*" appears.

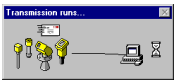

VEGA Visual Operating
The registry must be updated and Windows must be restarted to apply the changes.
VVO will now shut down.
Ja
Nein

Note: As a rule, a Windows® restart is not necessary.

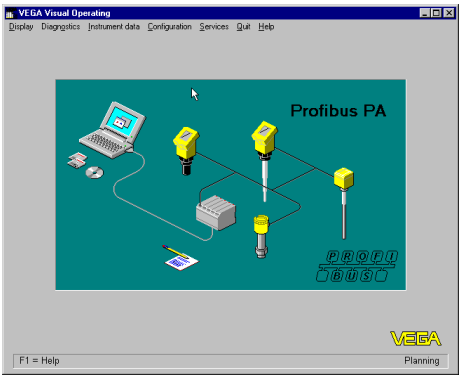
- Now start VVO (restart).



- Click to "*Planning*" and then to "*OK*".

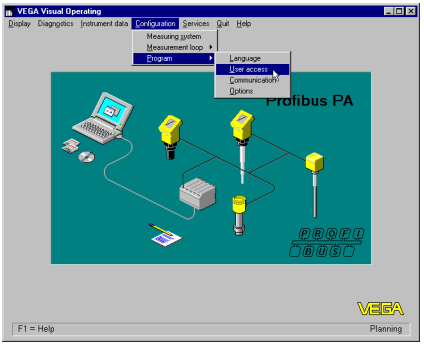


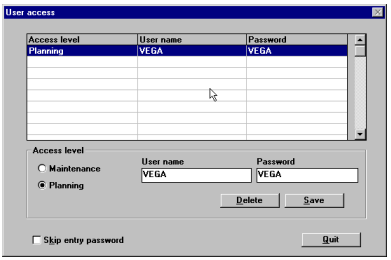
The VVO software asks again for user identification and then reads in all VEGA Profibus sensors found. You now see the VVO main menu window.



User identification

The preadjusted user identification can be modified at a later time in the menu "*Configuration/Program/User access*".

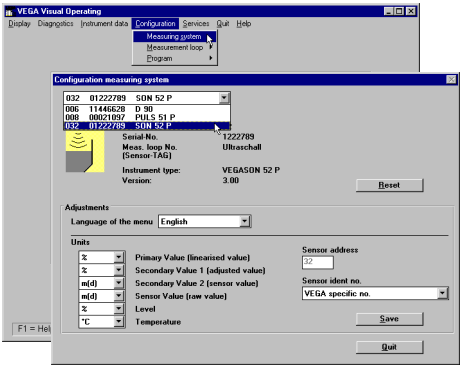




Configuration

Configuration info

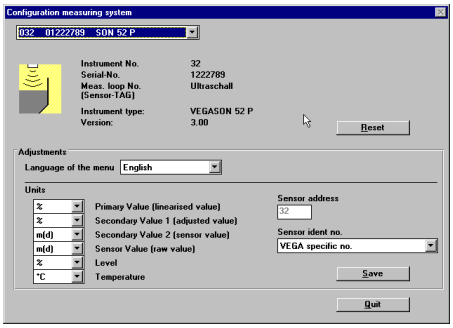
- Choose the menu "*Configuration/Measuring system*".



You reach the menu window "*Configuration measuring system*". In this window you get complete information on the VEGA sensors connected to the Profibus.

Software addressing

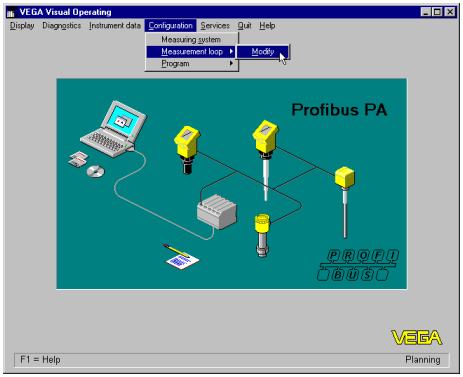
If the DIP switch in the sensor is set to address 126 or higher, the address can be modified in the menu window "*Configuration measuring system*". Enter a free address in the field "*Sensor address*".



If the sensor address has been adjusted with the DIP switch from 1 ... 125, the address number in the field "*Sensor address*" is grey and cannot be changed at this point.

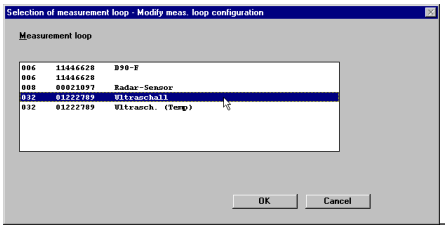
Create new measurement loop

- Choose the menu "C*onfiguration/Measurement loop/Modify*".



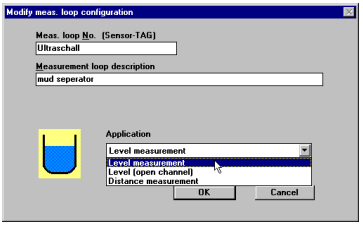
The menu window "*Selection of measurement loop - Modify meas. loop configuration*" opens.

- Here you choose the sensor to be configured.



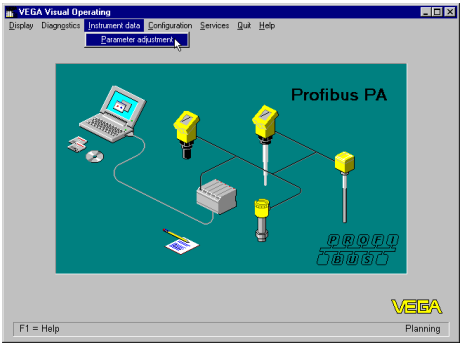
The measurement loops are listed as a sequence of sensor addresses with serial number and any existing name.

- Choose in the window "*Modify meas. loop configuration*" the application and enter a name for the measurement loop.



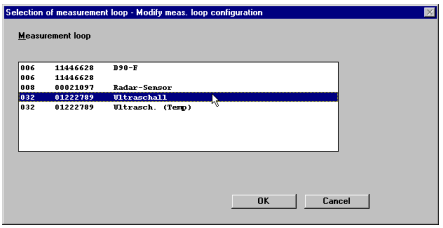
Parameter adjustment 1

In the menu "*Instrument data/Parameter adjustment*" you carry out all important sensor adjustments.



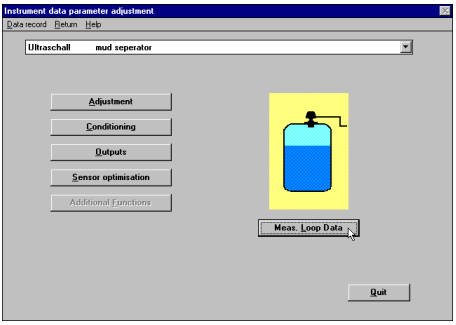
- Choose the menu "***Instrument data/Parameter adjustment***" and then the sensor on which you want to carry out the parameter adjustment.

In the opening menu window, you now see the measurement loop names and descriptions previously entered under "*Create new measurement loop*". If you have only configured or connected one sensor, there will naturally be a choice of only one sensor.

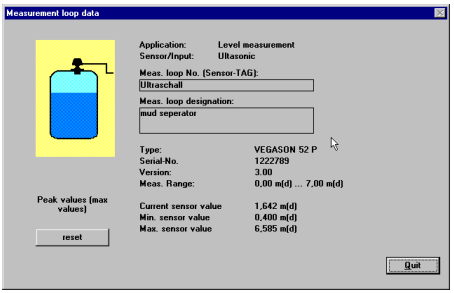


- Click to the sensor or the measurement loop for which you want to carry out the parameter adjustment.
- Then click to "*OK*", the menu window "*Instrument data parameter adjustment*" opens.

Measurement loop data

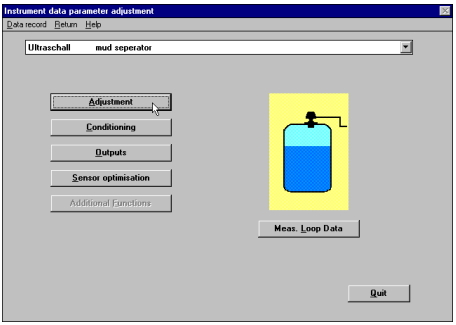


- When clicking "*Meas. loop data*", the most important measurement loop data will be displayed.

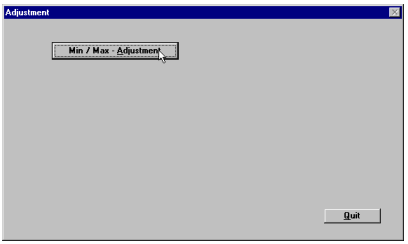


- Click to "*Quit*" and you are again in the menu window "*Instrument data parameter adjustment*".

Adjustment



- Click to "*Adjustment*".

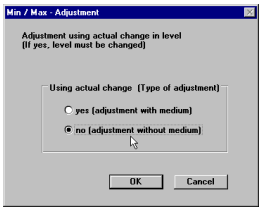


- Click in the menu window "*Adjustment*" to "*Min/Max-Adjustment*".

You can carry out the min./max. adjustment *"with medium"* (adjustment by means of the real level) or *"without medium"* (without taking the real level into account, i.e. with empty vessel).

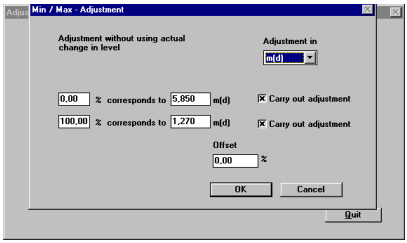
Generally, you will carry out the adjustment without medium, so you are completely independent of the actual vessel filling during the adjustment. If you want to carry out the adjustment with medium, you have to carry out the min. adjustment with emptied (also partly emptied) vessel and the max. adjustment with filled (also partly filled vessel). It is therefore easier and faster to carry out the adjustment without medium.

- Choose "*no (adjustment without medium)*".


Min / Max - Adjustment
Adjustment using actual change in level
(If yes, level must be changed)
Using actual change (Type of adjustment)
yes (adjustment with medium)
no (adjustment without medium)
OK
Cancel

In the menu window "Min/Max-Adjustment" you choose e.g. the level distance corresponding to 100 % and 0 %. Of course, you can also enter the distance values e.g. at 20 % and 75 % filling.

If the two points are too close together, e.g. at 45 % and 49 %, this can cause a considerable meas. error, as the sensor generates by means of the two adjustment points a linear correlation between filling volume (%) and meas. distance.



- Choose if you want to carry out the adjustment in *meters* (m) or in *feet* (ft).
- Enter a distance for the upper and lower level and the extent of filling in % corresponding to each distance.

In the example, the 0 % filling is at a product distance of 5.850 m and the 100 % filling at a product distance of 1.270 m.

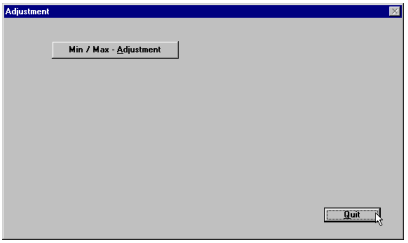
- Confirm the adjustments with "*OK*" and after a message is displayed, you are again in the menu window "*Adjustment*".

Note
With the adjustment also the operating range of the sensor is determined again.
If you want to measure over the adjustment limits, you should increase the operating range appropriately. (Instrument data - Parameter adjustment - Sensor optimisation - Meas. environment - Operating range)
OK

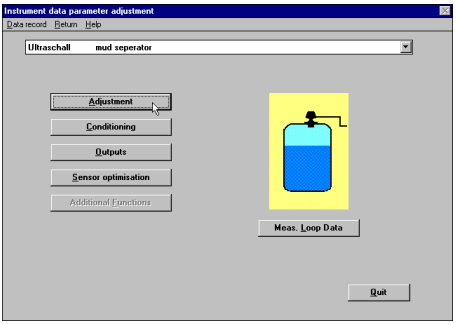
Note:

The sensor is delivered with the measuring range set to the same value as the operating range. After the sensor has been adjusted, the operating range corresponds to the adjustment range. The sensor can only detect levels within the defined operating range. For level detection outside the operating range, e.g. if you want to detect 108 % and -10 %, the operating range must be corrected accordingly in the menu "*Sensor optimisation/ Meas. environment*" (see the following chapter "Sensor optimisation", "Meas. environment/Operating range").

- Click in the menu window "*Adjustment*" to "*Quit*".



You are again in the menu window "*Instrument data parameter adjustment*".

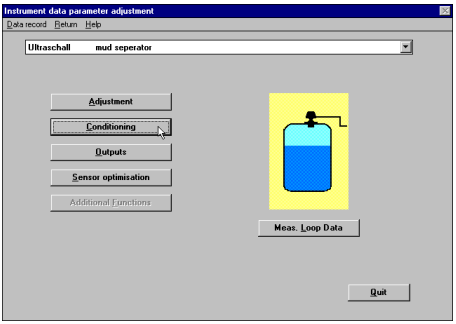


The sensor electronics has two characteristics points (at min. and max.) from which a linear proportionality between product distance and the percentage of filling of the vessel is generated.
Of course, the characteristics points must not necessarily be at 0 % and 100 %, however they should be as far apart as possible (e.g. at 20 % and at 80 %). The difference between the characteristics points for the min./max. adjustment should be at least 20 mm product distance. If the characteristics points are too close together, the possible measuring error increases. Ideal would be to carry out the adjustment as shown in the example, at 0 % and at 100 %.

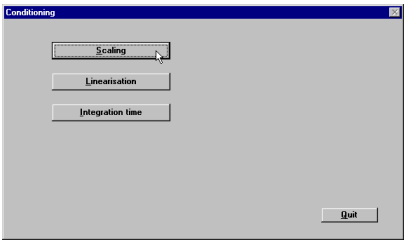
In the menu "*Instrument data/Parameter adjustment/Conditioning/Linearisation*" you can enter later, if necessary, a correlation between product distance and % extent of filling other than linear (see later subitem Linearisation).

Scaling

- Click in the menu window "*Instrument data parameter adjustment*" to "***Conditioning***".

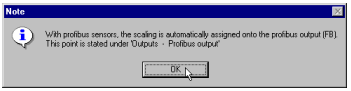


The menu window "*Conditioning*" opens.



- Click to "***Scaling***".

The message is displayed that you will find this function on Profibus sensors under the menu item "*Outputs*" in the menu window "*Instrument data parameter adjustment*".

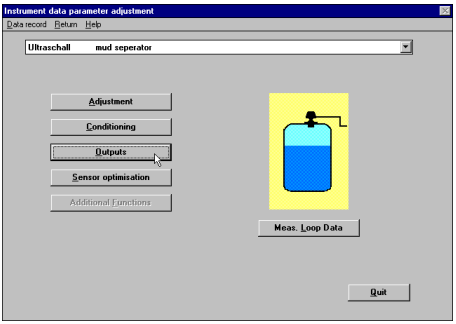

Note
With profibus sensors, the scaling is automatically assigned onto the profibus output (FB).
This point is stated under 'Outputs - Profibus output'
OK

- Confirm the message with "***OK***".
- Click in the menu window "*Conditioning*" to "***Quit***".

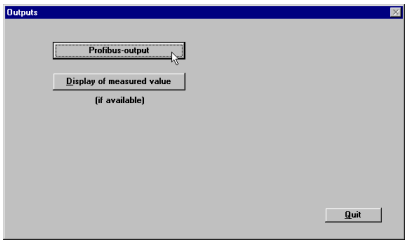
You are again in the menu window "*Instrument data parameter adjustment*".

Scaling of the output signal

- Click in the menu window "*Instrument data parameter adjustment*" to "***Outputs***".



- Click to "*Profibus output*".



In the window "*Profibus output*" you can determine the options for the Profibus output (acc. to the Profibus PA instrument profile).

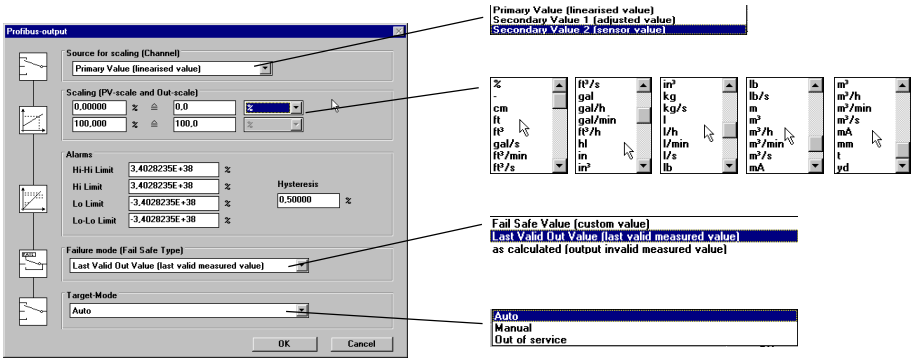
VEGA Profibus sensors operate in the so-called profile 3, in which the structure of the measured value processing has been determined (see also chapter "8.2 Function diagram"). In this software diagram you can see the structure of the measured value processing acc. to profile 3 (schematic presentation).

As physical unit you can choose *"dimensionless* (plain numbers), *volume, mass, height and distance"* and assign an appropriate unit of measurement (e.g. l, hl). The sensor display then shows the measured value in the selected physical quantity and unit.

- Save the adjustments in the menu "*Profibus output*" with "*OK*".

The adjustments are now transferred to the sensor and you are again in the menu window "*Outputs*".

- Click in the menu window "*Outputs*" to "*Quit*".
- Click in the menu window "*Instrument data parameter adjustment*" to "*Quit*".

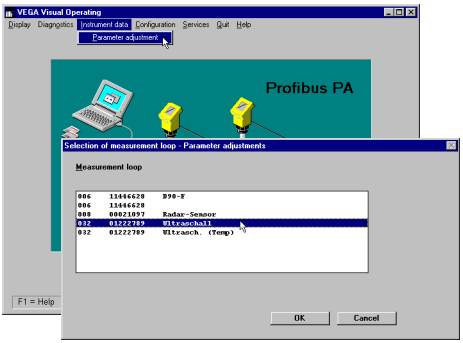


Sensor optimisation

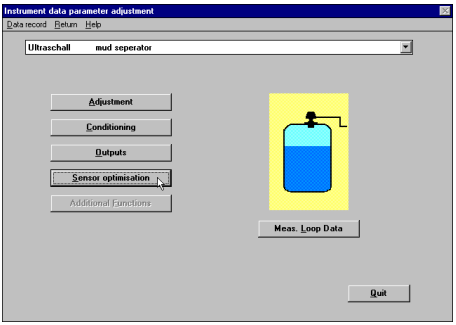
In the menu "*Sensor optimisation*" you prepare the sensor for the meas. environment. To do this, you carry out special optimising adjustments, like e.g. optimisation of the sensor mounting location by means of an echo curve.

Meas. environment/Operating range

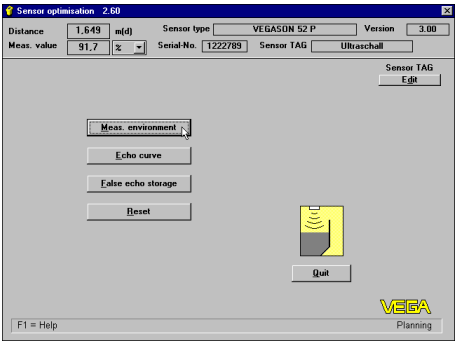
- Choose the menu "*Instrument data parameter adjustment*" and then the sensor.



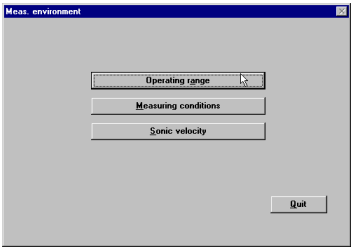
- Choose in the menu window "*Instrument data parameter adjustment*" the menu item "*Sensor optimisation*".



- First click to "*Meas. environment*".



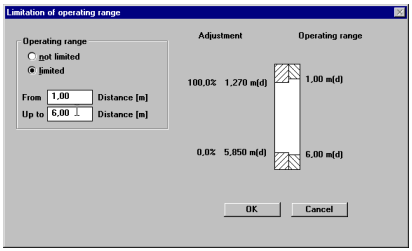
The window "*Meas. environment*" opens.



With the menu item "*Operating range*" you can define a sensor operating range that deviates from the meas. range (depending on the sensor type) and from the "*Min/Max adjustment*". By default, the operating range corresponds otherwise to the min./max. adjustment (span), i.e. the meas. range.

Generally, it is better to set the operating range approx. 5 % wider than the adjusted measuring range (span) defined by the min./max. adjustment.
In the example:
- Min. adjustment to 1.270 m,
- Max. adjustment to 5.85 m.

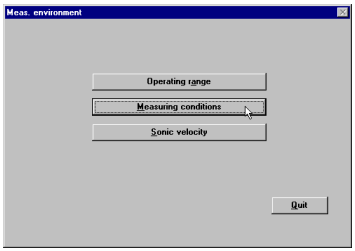
In the example, you would have set the operating range from 1 m to 6 m.



- Save the adjustments with "*OK*" and you are again in the menu window "*Meas. environment*".

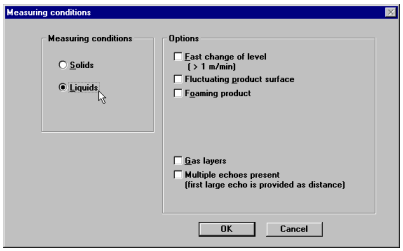
Meas. environment/Meas. conditions

- Click in the menu window "*Meas. environment*" to "*Meas. conditions*".



- In the menu window "*Measuring conditions*" you click on the options corresponding to your application.
- Confirm with "*OK*".

After a few seconds, during which the adjustments are permanently saved in the sensor, you are again in the window "*Meas. environment*".

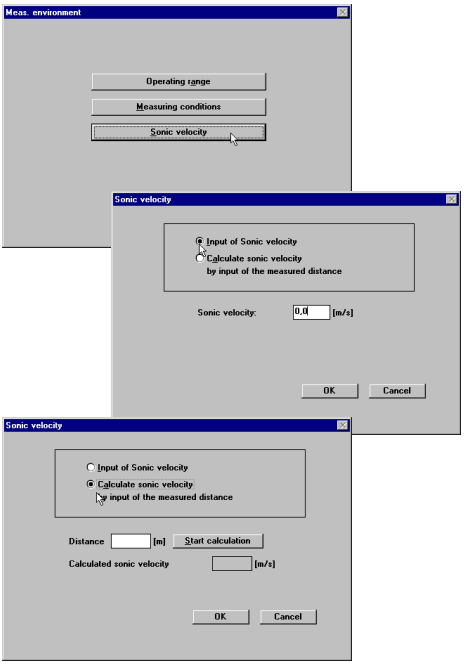


Meas. conditions/Sonic velocity

In the menu item "*Sonic velocity*" adjustments are only necessary when using the sensor in a gas composition deviating from air. If you measure in a gas composition deviating from air, e.g. pure nitrogen, the sonic velocity changes. Without correction, the measuring result would be incorrect.

In the menu "*Sonic velocity*" the sonic velocity can be set to a value corresponding to a different gas composition.

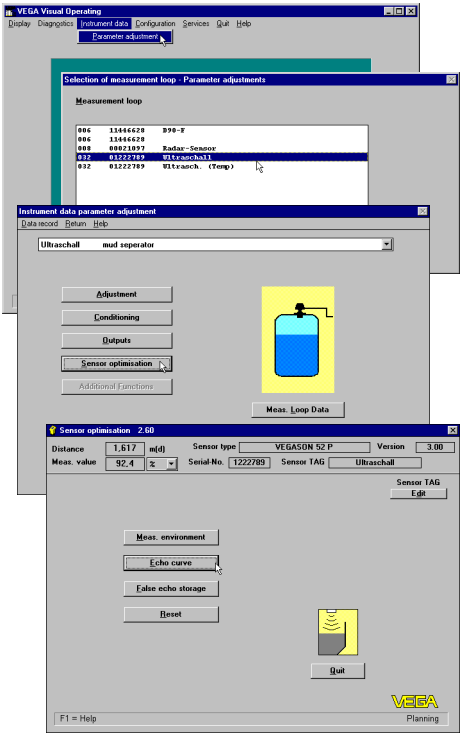
- With "*OK*" you save the adjustments in the sensor.
- Click in the window "*Meas. environment*" to "*Quit*".



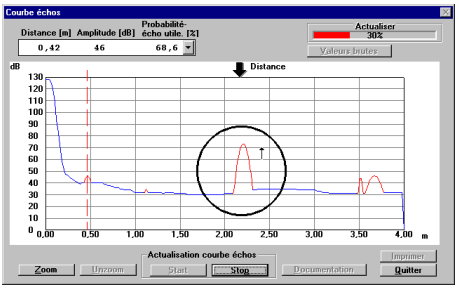
You are again in the menu window "*Sensor optimisation*".

Echo curve

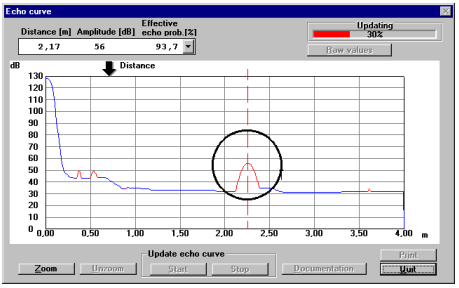
With the menu item "*Echo curve*" in the menu window "Sensor optimisation" you can see the course and the strength of the detected ultrasonic echo. If, due to vessel installations, you expect strong false echoes, a correction (if possible) of the mounting location and orientation (during simultaneous monitoring of the echo curve) can help localise and reduce the size of the false echoes.



In the following illustration, you see the echo curve with a false echo nearly as large as the product echo (before correcting the sensor orientation, i.e. pointing the sensor directly at the product surface).


Courbe échos
Distance [m] Amplitude [dB] Probabilité écho utile [%]
0,42 46 68,6
Actualiser
30%
Valeurs brutes
dB
Distance
130 120 110 100 90 80 70 60 50 40 30 20 10 0
0,00 0,50 1,00 1,50 2,00 2,50 3,00 3,50 4,00 m
Actualisation courbe échos
Imprimer
Zoom Unzoom Start Stop Documentation Quitter

In the next illustration, you see the echo curve after optimum orientation of the sensor to the product surface (sensor axis perpendicular to the product surface). The false echo, e.g. caused by a strut, is now reduced by more than 10 dB and will no longer influence the measurement.

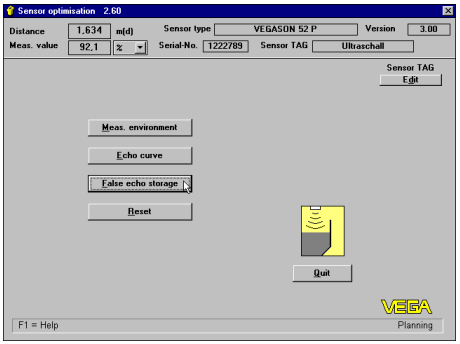

Echo curve
Distance [m] Amplitude [dB] Effective echo prob.[%]
2,17 56 93,7
Updating
30%
Raw values
dB
Distance
130 120 110 100 90 80 70 60 50 40 30 20 10 0
0,00 0,50 1,00 1,50 2,00 2,50 3,00 3,50 4,00 m
Update echo curve
Print
Zoom Unzoom Start Stop Documentation Quit

- Quit the menu "*Echo curve*" with "***Quit***".

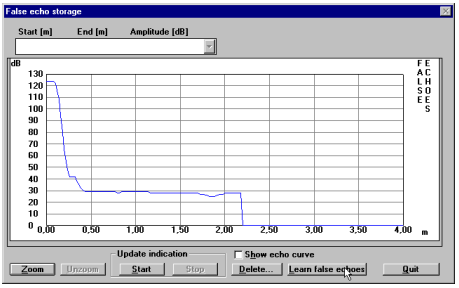
False echo storage

With the menu item "*False echo storage*" in the menu "*Sensor optimisation*" you can authorise the sensor to save false echoes. The sensor electronics then saves the false echoes in an internal database and assigns them a lower level of importance than the useful echo. Carry out the false echo storage in the emptied vessel.

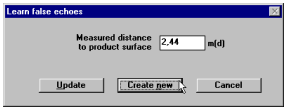
- Click in the menu window "*Sensor optimisation*" to the menu item "***False echo storage***".



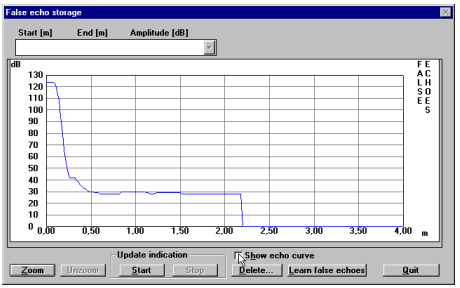
- Now click in the opening menu window "*False echo storage*" to "***Learn false echoes***". A small window opens.



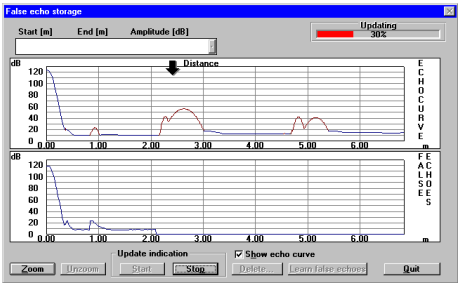
- Enter here the verified product distance or the distance to the vessel bottom and click to "***Create new***".



You hereby authorise the sensor to mark all echoes before the product echo as false echoes. This prevents the sensor from erroneously detecting a false echo as level echo.



- Click to "***Show echo curve***".



The false echo marking and the real echo curve (top) are shown.

- Quit the menu with "***Quit***".

You are again in the menu window "*Sensor optimisation*". With the menu item "*Reset*" you reset all options out of the menu "*Sensor optimisation*" to default.

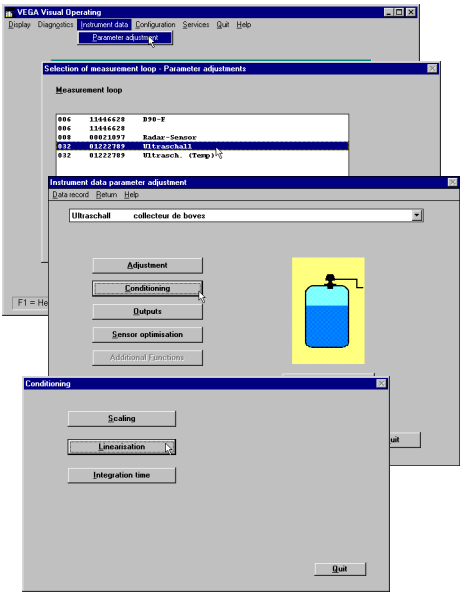
- Quit the menu window "*Sensor optimisation*" with "***Quit***" and with "***Quit***" the menu window "*Sensor optimisation Sensor choice*".

You are then in the initial menu window "*Instrument data parameter adjustment*".

Parameter adjustment 2

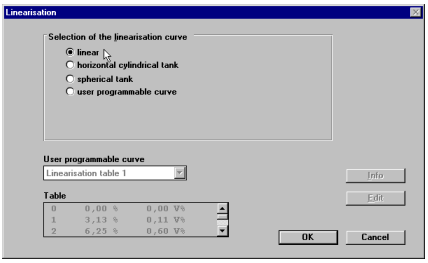
Linearisation

The correlation between level and volume is defined by so-called linearisation curves. If there is a correlation in your vessel between level ("*Percentage value*" of the level) and the volume (value of the volume) other than linear, choose in the menu window "*Conditioning*" the menu item "*Instrument data/Parameter adjustment/Conditioning*".



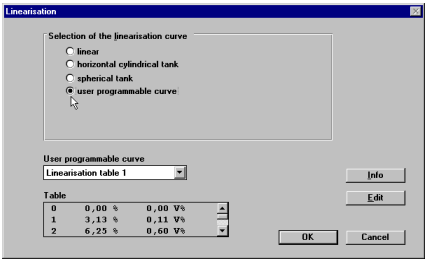
- Click in the menu window "*Conditioning*" to the menu item "*Linearisation*".

The menu window "*Linearisation*" opens, in which a linear correlation between percentage value of the level and the percentage value of the volume is preadjusted.

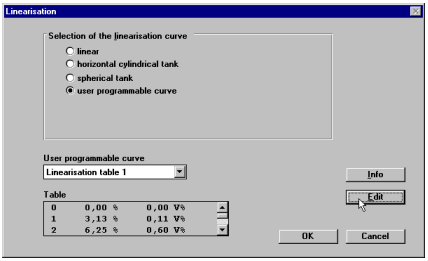


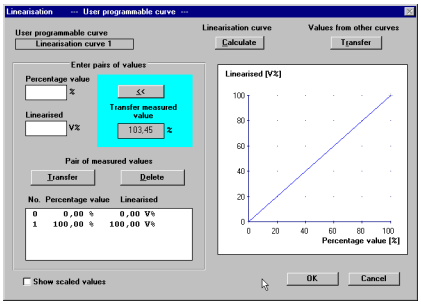
Beside the two programmed linearisation curves "*Cylindrical tank*" and "*Spherical tank*" you can also enter "*user programmable curves*". Linear means that there is a linear correlation between level and volume.

User programmable linearisation curves



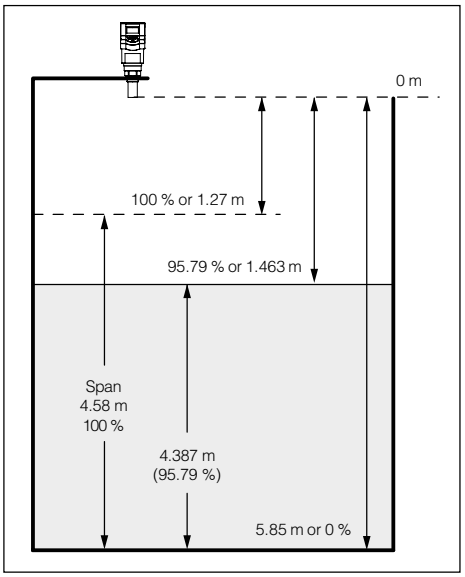
- Click to "*User programmable curve*" to enter your own vessel geometry or a user programmable filling curve.
- Click to "*Edit*".





The user programmable linearisation curve is generated by index markers. Each index marker consists of a value pair. A value pair is generated from a value "*Linearised*" and a value "*Percentage value*". *"Percentage value"* represents the distance as a percentage of the level. "*Linearised*" represents the percentage of vessel volume at a certain percentage of the level.

In the field "*Transfer measured value*" the current level as a percentage of the adjusted span is displayed. The measuring window has already been adjusted with the min./max. adjustment. In the example, the span is 4.58 m and is between 5.85 m (empty) and 1.27 m (full), see the following presentation.



5.85 m meas. distance correspond to 0 % level. 1.27 m meas. distance correspond to 100 % level. The span is therefore 4.58 m (5.85 m – 1.27 m = 4.58 m).

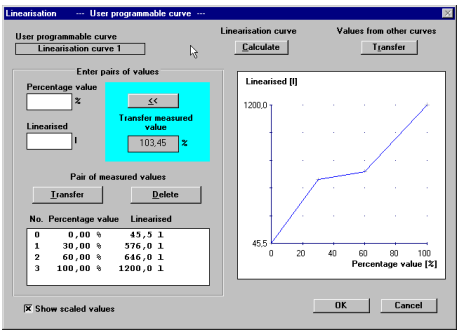
A percentage value of 95.79 % then means that 4.387 m of the adjusted span (4.58 m) have been reached:
4.58 • 0.9579 = 4.387 m.

The distance (product distance), outputted by the sensor, if you have chosen "*Distance*", is then:
5.85 – (4.58 • 0.9579) = 1.463 m.

If the index markers or value pairs of your vessel are not known, you must gauge the vessel incrementally or calculate it with the vessel calculation program of VVO.

Defining the linearisation curve by incremental filling

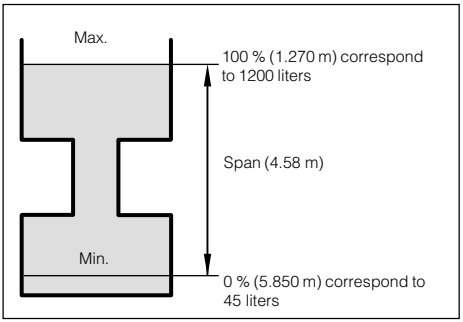
In the characteristics of the example, you see four index markers or value pairs. There is always a linear interpolation between the index markers. The example vessel consists of three cylindrical segments of different height and diameter. The middle segment has a considerably smaller diameter.



- Click in the check box "***Show scaled values***", to have the selected unit of measurement displayed on the y-axis (left bottom part in the menu window).

Index marker 1 is at 0 % filling (*percentage value [%]*), corresponding in the example to an actual distance to the product surface of 5.850 m (empty vessel). The volume is 45 liters (fluid remaining in the vessel).
Index marker 2 is at a filling level of 30 % (30 % of the meas. distance of 1.270 m … 5.850 m). At a filling level of 30 %, there are 576 liters in the vessel (in our example).
Index marker 3 is at a filling level of 60 %. At this filling level there are 646 liters in the vessel.
Index marker 4 is at a filling level of 100 % (product distance 1.270 m), where 1200 liters are in the vessel.

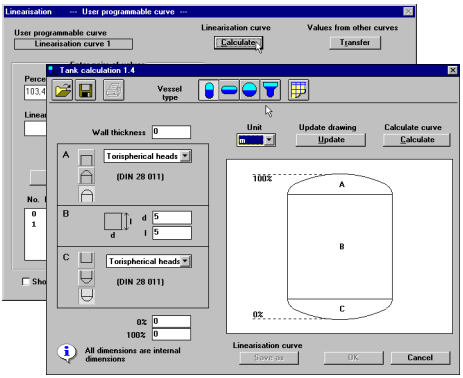
Max. 32 index markers can be entered per linearisation curve (value pairs).



Calculating the linearisation curve

(use previous tank example)

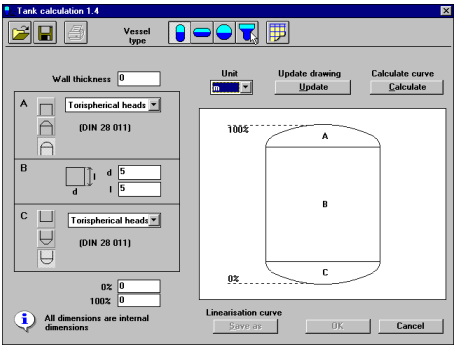
In the menu window "*Linearisation -- user programmable curve --*" you can start the vessel calculation program. With the vessel calculation program you can calculate (using dimensions from the technical drawings of the vessel) the correlation of filling height to filling volume. If the curve is defined this way, gauging by incremental filling is not necessary - your sensor can then output volume as a function of level.

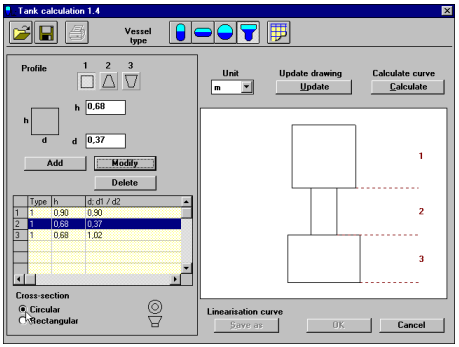


- Click to "*Calculate*".

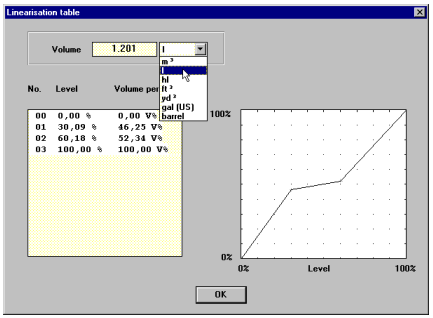
The tank calculation program starts. In the top left corner you choose the vessel type (upright tank, cylindrical tank, spherical tank, individual tank form or matrix). When choosing matrix, you can enter a user programmable linearisation curve by means of index markers. This corresponds to the entering of value pairs (linearisation points), as previously described.
In the following example, the tank calculation program calculates the linearisation curve of a vessel corresponding to the vessel in the previous gauging example.

- Click to "***individual tank form***" and choose three round tank segments with the dimensions 0.99 m • 0.9 m (height by diameter), 0.68 m • 0.37 m and 0.68 m • 1.02 m (this tank form corresponds to the tank form of the gauging example).



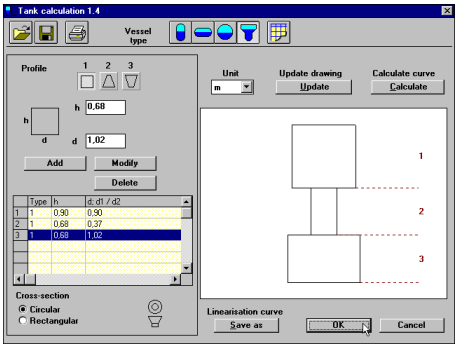


- Click to "*Calculate*".



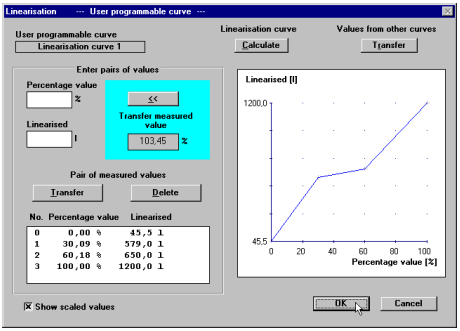
After a short calculation time, the levels as a percentage of span and the corresponding volume percentages are shown. The outputted curve shows this correlation in a diagram.

- Quit the linearisation table with "*OK*".



You are again in the menu window "*Tank calculation*".

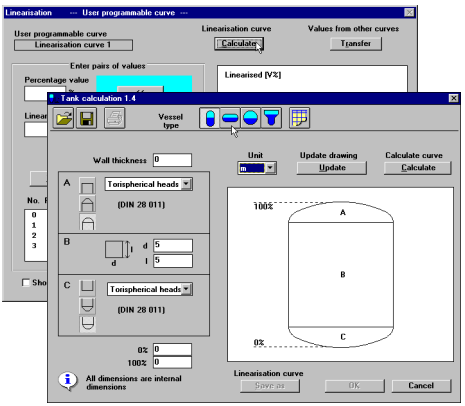
- Click to "*OK*" to save the tank calculation.



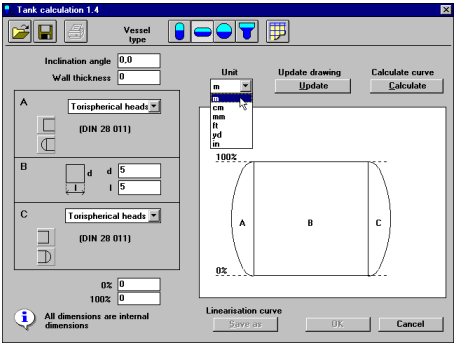
You are again in the menu window "*Linearisation -- user programmable curve --*". The volume percentages, with the corresponding level percentages, are shown. When clicking in the bottom left part of the menu window to "*Show scaled values*", liters will be displayed according to the adjustment in the menu "*Instrument data/Parameter adjustment/Conditioning/Scaling*".

Calculate cylindrical tank

- Click in the menu window "*Linearisation -- user programmable curve --*" to "*Calculate*" and in the menu window "*Tank calculation*" to the symbol for cylindrical tanks.

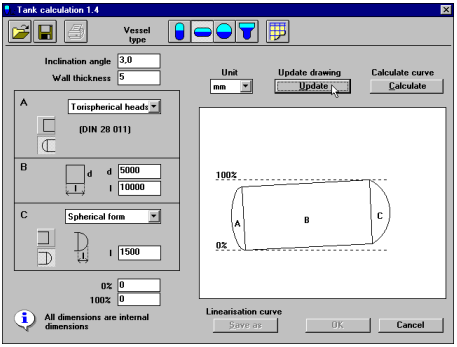


The menu window for the adjustment of the cylindrical tank opens.



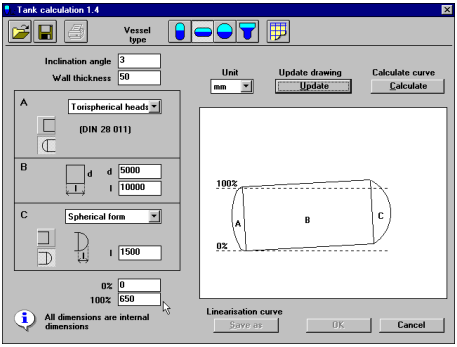
- Choose the meas. unit, e.g. mm, that should apply to the entered vessel dimensions.

The following example shows how to enter a cylindrical tank that is inclined by 3° and has a cylinder length of 10000 mm and a diameter of 5000 mm. The cylindrical tank has a 1500 mm wide, spherical form at the right end and a dished form at the left.



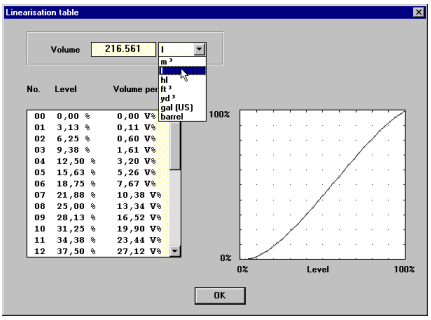
Note:
In the bottom left corner in the menu window "*Tank calculation*" you find the information "*All dimensions are internal dimensions*". The entering of a wall thickness is only necessary for the calculation of the dished boiler end as its mathematical calculation is based on the outer dimension.

Above the information *"All dimensions are internal dimensions*", you will find two fields with the percentage values 0 % and 100 %. Here you can shift the 100 % line or the 0 % line. In the example, the 100 % filling line was defined at a distance of 650 mm from the upper vessel edge (inside).



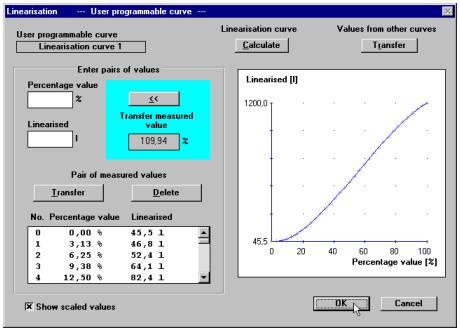
- Click to "*Calculate*".

You will get the calculated linearisation table after a short calculation time. By means of 32 linearisation points, a function correlating vessel volume to filling height is outputted. The example vessel has a filling of 216561 liters at the 100 % line or of 216.6 m^3. It is possible to output the volume value in barrels, gallons, cubic yards or cubic feet.



There is a linear interpolation between the linearisation points.

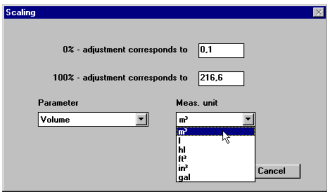
- Click to "*OK*" and you are again in the menu window "*Tank calculation*".
- Again click in the menu window "*Tank calculation*" to "*OK*" and you are in the linearisation menu.



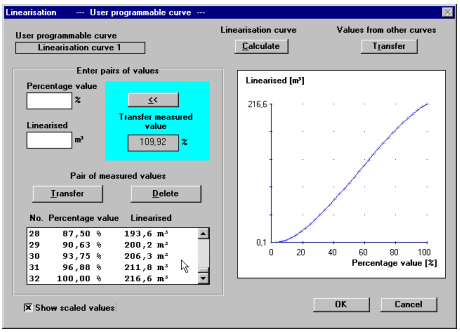
Here the calculated linearisation curve is again outputted. The volume information under "*Linearised*" now no longer corresponds to the calculated volume of the tank calculation program. Why?

In the menu "*Scaling*" (Instrument data/Conditioning/Scaling) you entered earlier that at 0 % filling there are 45 liters in the tank and at 100 % filling 1200 liters. The geometry of the calculated cylindrical tank was accordingly scaled down to a size that indeed evaluates to a volume of only 1200 liters. The modified linearisation curve was then applied to the volume data that you entered in the menu "*Scaling*".

If the true content of the calculated vessel should be outputted, the volume that was determined by the tank calculation program must be entered in the menu "*Scaling*".



The sensor then outputs the actual filling volume calculated from the entered vessel dimensions.



- Quit the menu with "*OK*".
- Confirm with "*OK*" and your individual linearisation curve is saved in the sensor.

Again in the menu window "*Conditioning*", you can enter with the menu item "*Integration time*" a measured value integration. This is recommended for agitated product surfaces, to prevent rapid fluctuation of the output signal and the measured value indication. The standard setting is an integration time of 0 seconds.

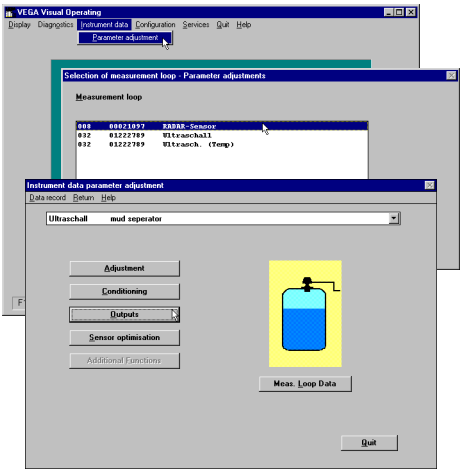
- Quit the menu with "*OK*". You are again in the menu window "*Instrument data parameter adjustment*".

- Quit the menu window with "*OK*".

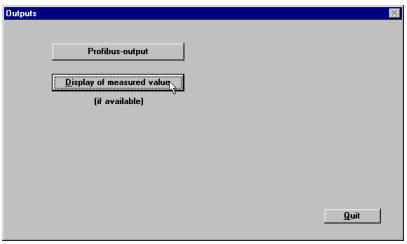
Parameter adjustment sensor display

In the menu item "Outputs“ you choose the scale and the unit in which your level should be displayed.

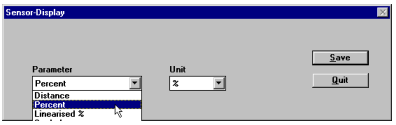
- Choose in the main menu window "*Instrument data parameter adjustment*“ and then the menu item "*Outputs*“.



- In the menu window "*Outputs*“ click to "*Display of measured value*“.



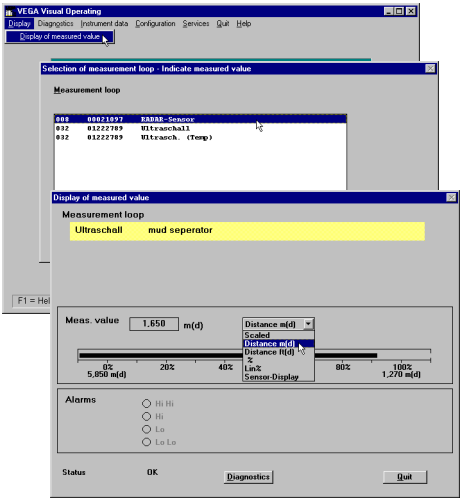
The menu window "*Sensor Display*“ enables the selection of the "*Parameter*“ and the "*Unit*“ (see also "8.2 Function diagram“).



- Click to "*Save*“ to save the adjustment.
- If the adjustments should remain unchanged, click to "*Quit*“.
- Click in the menu window "*Outputs*“ to "*Quit*“ and you are in the menu window "*Instrument data parameter adjustment*“.
- Click in the menu window "*Instrument data parameter adjustment*“ again to "*Quit*“.

Display of measured value

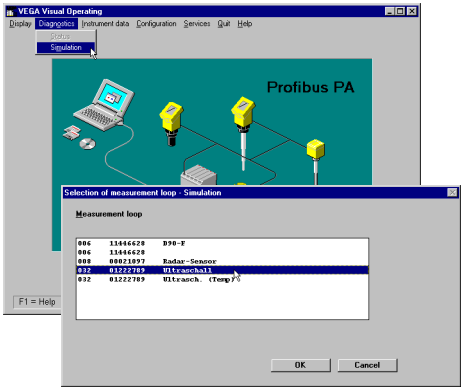
- Click in the main menu window to the menu "*Display/Display of measured value*“ and choose the measurement loop or the sensor which you want to have displayed.



- Choose in the line "*Meas. value*“ "*Distance*“ and the sensor product distance will be displayed. If you choose "*Scaled*“, e.g. the measured value will be displayed in liters or volume percent.

Simulation

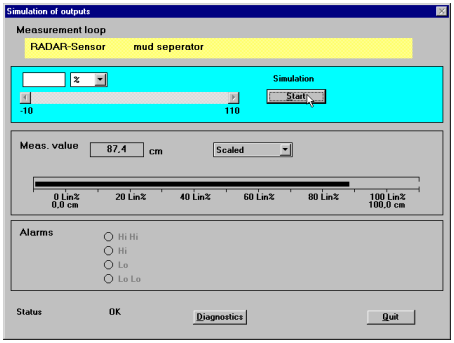
- Click to the menu "*Diagnostics/Simulation*" and choose the measurement loop.

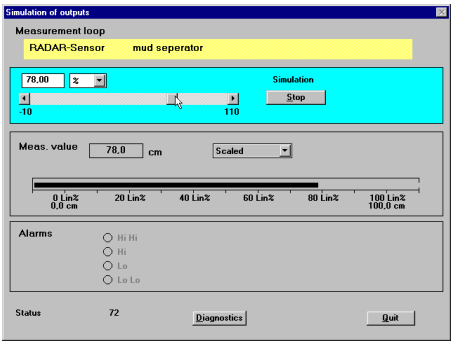


The menu window "*Simulation of outputs*" opens. In this menu window you can simulate the filling of the vessel or the measured value and the indication display to any value (simulate measured value).

First of all, the actual measured value is displayed.

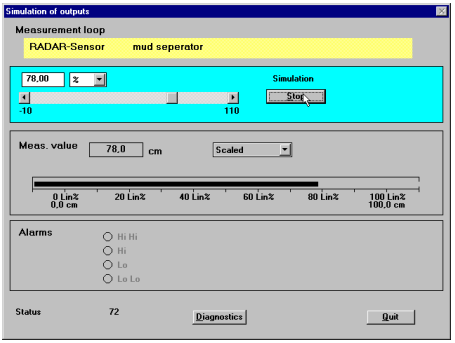
- Click to "*Start*" in the turquoise window segment.





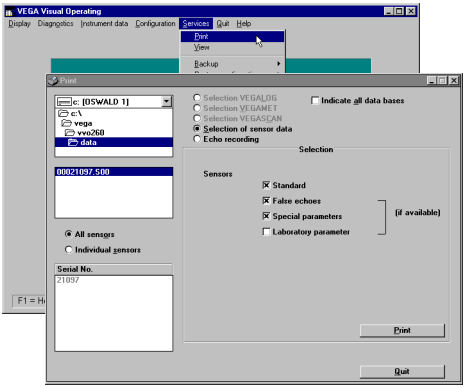
The grey scroll bar becomes active. With this scroll bar you can change the measured value to any value in the range of -10 % ... 110 % and thereby simulate the filling or emptying of the vessel. In the input box above the scroll bar you can enter any percentage value of filling.

Note:
The simulated measured value is outputted during adjustment with the PC until you stop the simulation mode.

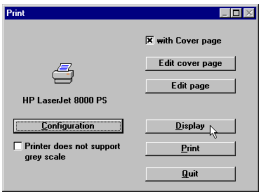


Print configuration and adjustments

- Click to "*Services/Print*".

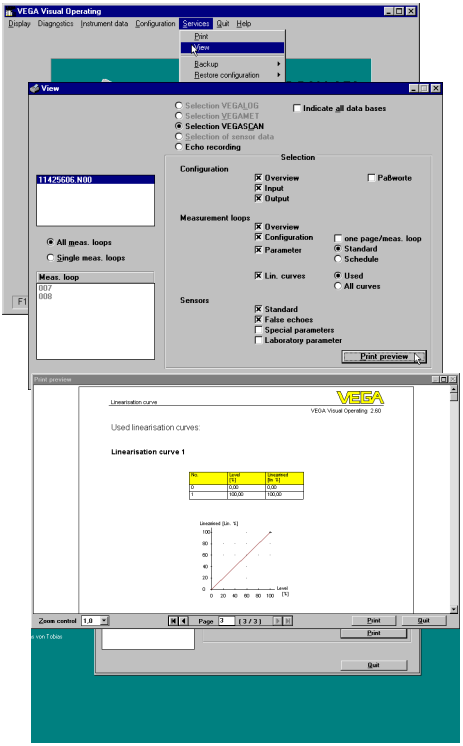


Before printing the complete configuration of all sensors, you can view the individual pages and …



… then print all or just certain pages.

With the menu "*View*" you can have the adjustments displayed in detail.

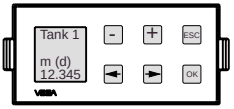


Backup

With the menu items "*Services/Backup/Signal conditioning instruments*" and "*Services/Backup/Sensors*" you save the configurations and parameter adjustments of VEGASON and of any individual sensor.

For further instructions see the manual "VEGA Visual Operating" (VVO).

6.3 Sensor adjustment with the adjustment module MINICOM



In addition to the PC, you can adjust the sensors with the small, detachable adjustment module MINICOM directly in the sensor.

With the adjustment module MINICOM, only the sensor-relevant adjustment such as e.g. scaling of the sensor display, operating range, meas. conditions, sensor display scaling or false echo storage are possible. However, not possible are all adjustment steps relating to configuration, conditioning and signal processing (configuration of the inputs and outputs, linearisation curves, simulation ...). This is only possible with the PC.

The adjustment module MINICOM is adjusted with six keys. A small display shows you, apart from the measured value, a short message on the menu item or the entered value of a menu adjustment.

The volume of information of the small display, however, cannot be compared with that of the adjustment program VVO, but with the help of the menu schematic for MINICOM, you will quickly find your way through the adjustment structure. In time, you might even be able to carry out your adjustments with the small module faster and more efficiently than with the PC.

Error codes:

E013 No valid measured value
- Sensor in the warm-up phase
- Loss of the useful echo

E017 Adjustment span too small

E036 Sensor program not operating
- Sensor must be reprogrammed (service)
- Fault signal also appears during programming

E040 Hardware failure, electronics defective

Adjustment steps

On pages 70 and 71 you will find the complete menu schematic of the adjustment module MINICOM.
Set up the sensor in the numbered sequence:

1. Address
2. Measurement in gases
3. Operating range
4. Adjustment
5. Conditioning
6. Meas. conditions
7. False echo storage (only required when errors occur during operation).
8. Indication of the useful and noise level
9. Outputs

Short explanations to the setup steps 1 ... 9 follow.

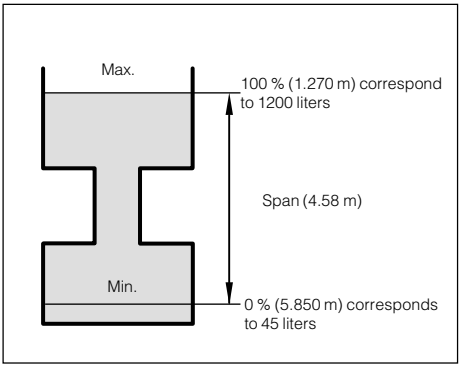
1. Address

Choose a free bus address with the DIP switch (see chapter "5.2 Sensor address").

Adjustment is only necessary if the measurement is made in gases deviating from air (CO_2, He, etc.). When measuring in gases, sound the distance of the sensor to the product surface and enter this in the menu item "Measurement in gases". The sensor can then take the modified (compared to air) sonic velocity in gases into account and output correct levels.

Without special adjustment, the operating range corresponds to the measuring range. Generally, it is useful to choose a slightly wider range (approx. 5 %) for the operating range than for the measuring range.

Example:
Min./max. adjustment: 1.270 ... 5.850 m;
adjust operating range to approx.
1.000 ... 6.000 m.

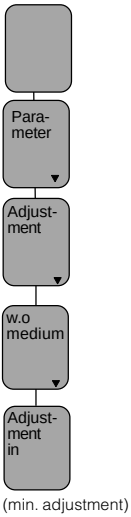


Under the menu item "*Adjustment*" you inform the sensor about the measuring range.

You can carry out the adjustment with or without medium. Generally you will carry out the adjustment without medium, as you can then adjust without a filling/emptying cycle.

(adjustment independent of the level)

Key adjustment Display indication



OK

OK

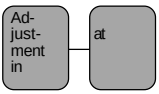
OK

OK

(min. adjustment)

\+ The distance indication flashes and you can choose "feet" and "m".

OK Confirm the adjustment with "*OK*".

→ 

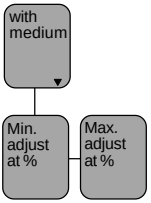
\+ or – With "*+*" and "*–*" you adjust the percentage value for the min. value (example 0.0 %).

OK The adjusted percentage value is written in the sensor and the distance for the min. value corresponding to the percentage value flashes

[+] or [–] With the "+" or "–" key you can assign a level distance (example 5.85 m) to the previously adjusted percentage value. If you do not know the distance, you have to do a sounding.

[OK] The adjusted product distance is written in the sensor and the display stops flashing.

You thereby adjusted the lower product distance as well as the percentage filling value corresponding to the lower product distance.



Fill the vessel e.g. to 10 % and enter 10 % in the menu "*Min. adjust*" with the "+" and "–" keys. Then fill the vessel, e.g. to 80 % or 100 % and enter 100 % in the menu "*Max. adjust*" with the "+" and "–" keys.

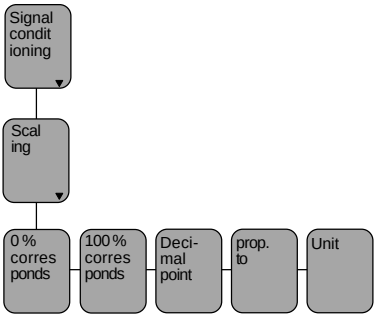
For level detection outside the operating range, the operating range must be corrected respectively in the menu "*Sensor optimisation/Operating range*".

[→] at

(max. adjustment)

Now you make the max. adjustment (upper product distance) (example: 100 % and 1.270 m product distance). First enter the percentage value and then the product distance corresponding to the percentage value.

The difference between the adjustment values of the lower product distance and the upper product distance should be as big as possible, preferably at 0 % and 100 %. If the values are very close together, e.g. lower product distance indication at 40 % (3.102 m) and upper product distance adjustment at 45 % (3.331 m), the measurement will be inaccurate. A characteristic curve is generated from the two points. Even the smallest deviations between actual product distance and entered product distance will considerably influence the slope of the characteristic curve. If the adjustment points are too close together, small errors inflate to considerably larger ones when the 0 % or the 100 % value is outputted.



Under the menu item "*Conditioning*" you assign a product distance at 0 % and at 100 % filling. Then you enter the parameter and the physical unit as well as the decimal point.

Enter in the menu window "*0 % corresponds*" the numerical value of the 0 % filling. In the example of the adjustment with the PC and the adjustment software VVO this would be 45 for 45 liters.

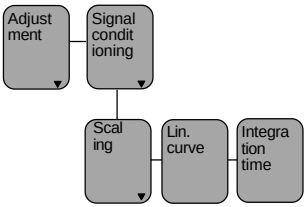
- Confirm with "*OK*".

With the "—>" key you change to the 100 % menu. Enter here the numerical value of your parameter corresponding to a 100 % filling. In the example 1200 for 1200 liters.

- Confirm with "*OK*".

If necessary, choose a decimal point. However, note that only max. 4 digits can be displayed. In the menu "*prop. to*" you choose the physical quantity (mass, volume, distance…) and in the menu "*Unit*" the physical unit (kg, l, ft³, gal, m³ …).

Linearisation:



A linear correlation between the percentage value of the product distance and percentage value of the filling volume is preadjusted. With the menu "Lin. curve" you can choose between linear, spherical tank and cylindrical tank. The generation of a customized linearisation curve is only possible with the PC and the adjustment program VVO.

(see menu schematic)

A false echo storage is always useful when unavoidable false echo sources (e.g. struts) must be minimised. By creating a false echo storage, you authorise the sensor electronics to record the false echoes and save them in an internal database. The sensor electronics treats these (false) echoes differently from the useful echoes and filters them out.

In the menu

you get important information on the signal quality of the product echo. The higher the "S-N" value, the more reliable the measurement (menu schematic MINICOM).

Ampl.: means amplitude of the level echo in dB (useful level)
S-N: means Signal-Noise, i.e. the useful level minus the level of the background noise

The bigger the "S-N" value (difference between the amplitudes of the useful signal and the background noise), the better the measurement:

> 50 dB	Measurement excellent
40 … 50 dB	Measurement very good
20 … 40 dB	Measurement good
10 … 20 dB	Measurement satisfactory
5 … 10 dB	Measurement sufficient
< 5 dB	Measurement poor

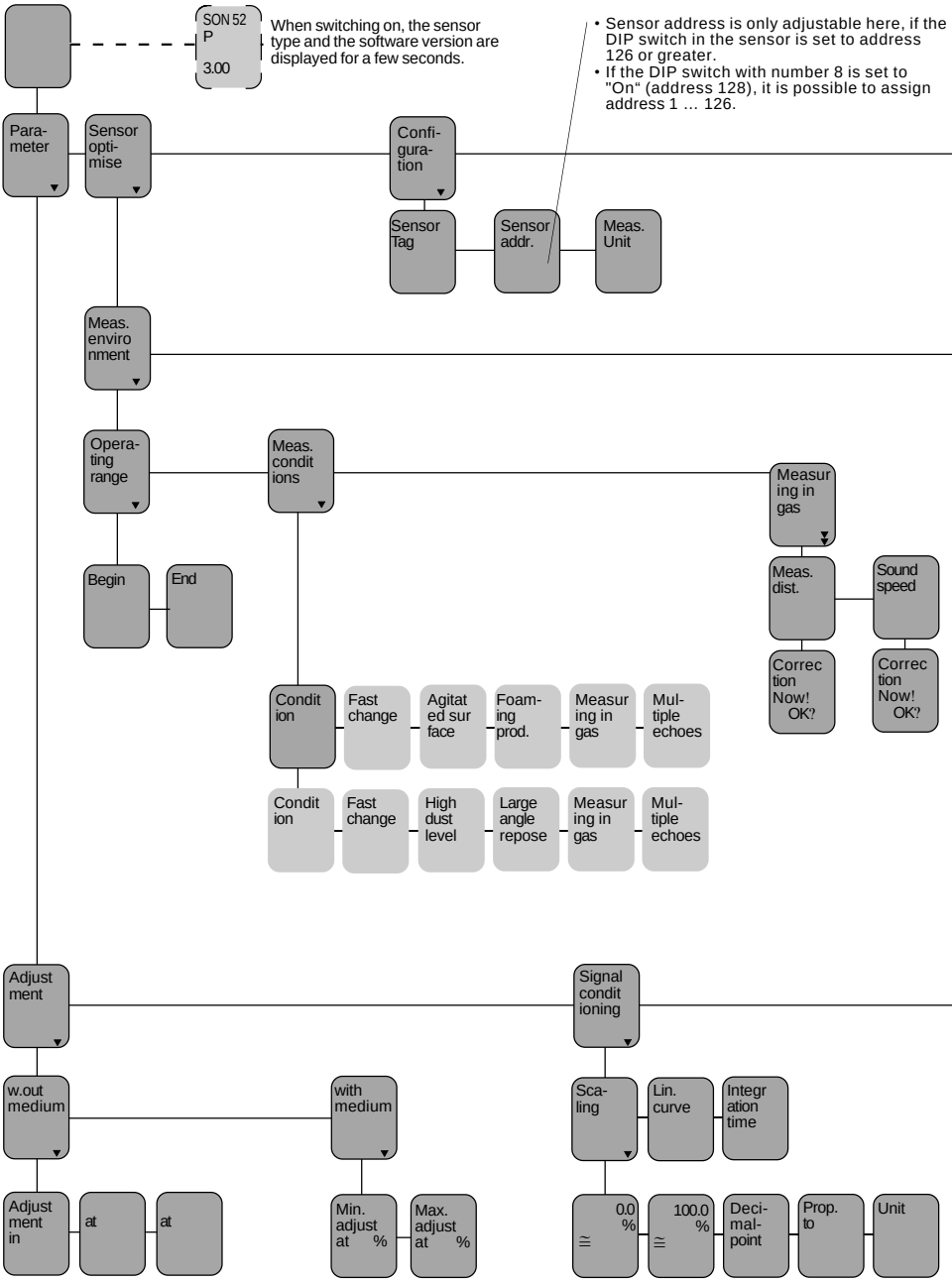
Ampl. = 68 dB
S-N = 53 dB

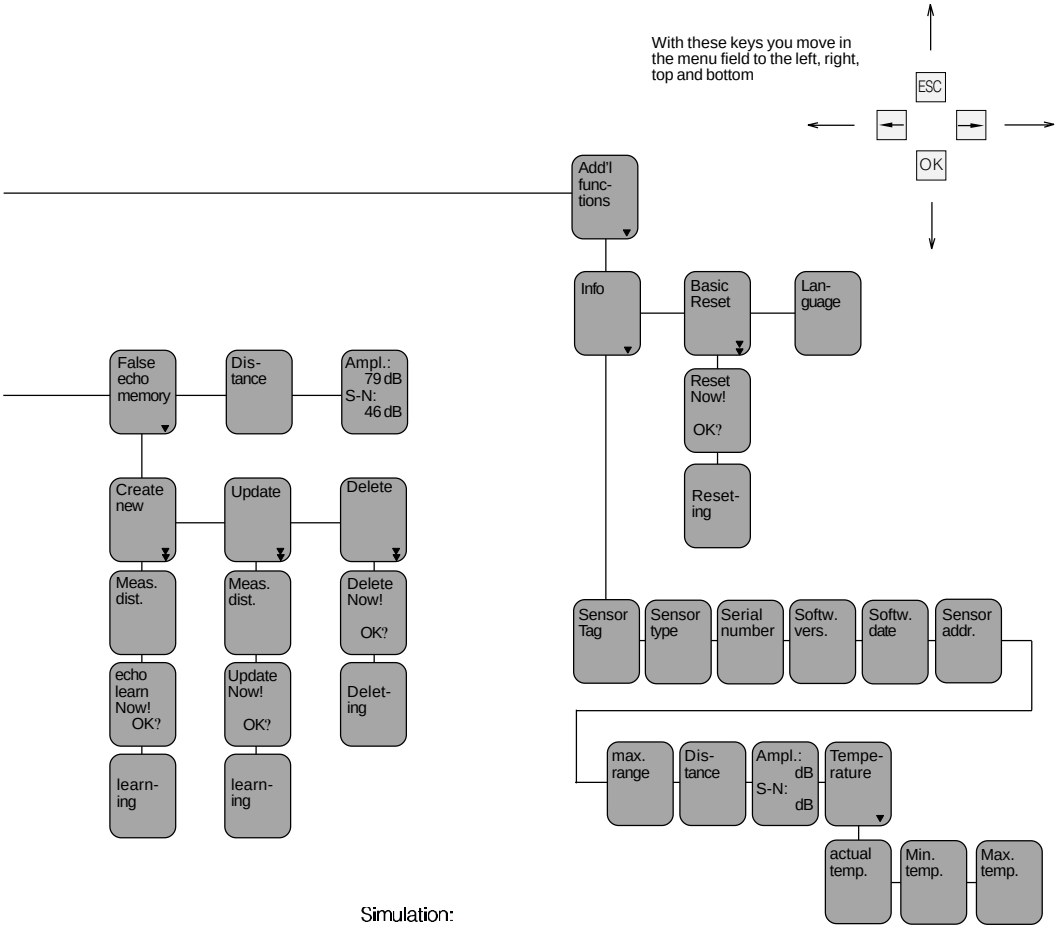
68 dB – 53 dB = 15 dB

This means that the noise level is only 68 dB – 53 dB = 15 dB.

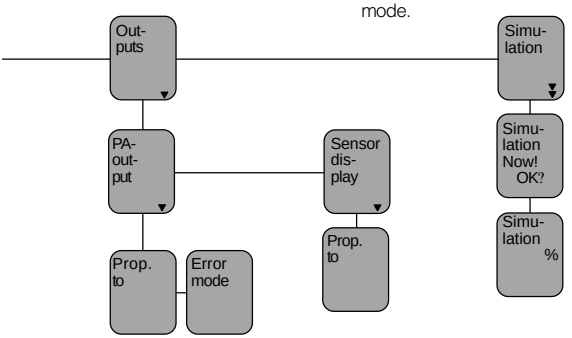
A 15 dB noise level with a 53 dB higher signal level would ensure a high degree of measurement reliability.

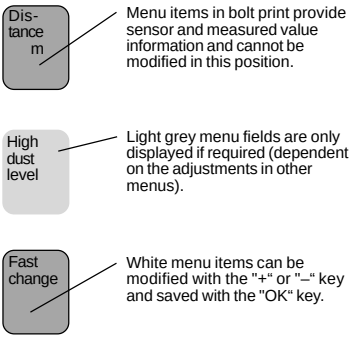
Under the menu "Outputs" you determine, for example, if the current output should be inverted, or which unit of measurement should be shown on the sensor display.


SON 52
P
3.00
When switching on, the sensor type and the software version are displayed for a few seconds.
• Sensor address is only adjustable here, if the DIP switch in the sensor is set to address 126 or greater.
• If the DIP switch with number 8 is set to "On" (address 128), it is possible to assign address 1 ... 126.
Para-meter
Sensor opti-mise
Confi-gura-tion
Sensor Tag
Sensor addr.
Meas. Unit
Meas. environment
Opera-ting range
Begin
End
Meas. condit ions
Condit ion
Fast change
Agitat ed sur face
Foam-ing prod.
Measur ing in gas
Mul-tiple echoes
Condit ion
Fast change
High dust level
Large angle repose
Measur ing in gas
Mul-tiple echoes
Measur ing in gas
Meas. dist.
Sound speed
Correc tion Now! OK?
Correc tion Now! OK?
Adjust ment
w.out medium
with medium
Adjust ment in
at
at
Min. adjust at %
Max. adjust at %
Signal condit ioning
Sca-ling
Lin. curve
Integr ation time
0.0 % ≙
100.0 % ≙
Deci-mal-point
Prop. to
Unit



Simulation:
One hour after the last simulation adjustment the sensor returns automatically to normal operating mode.




Dis-tance m
Menu items in bolt print provide sensor and measured value information and cannot be modified in this position.
High dust level
Light grey menu fields are only displayed if required (dependent on the adjustments in other menus).
Fast change
White menu items can be modified with the "+" or "–" key and saved with the "OK" key.

7 Diagnostics

7.1 Simulation

To simulate a certain filling, you can call up the function "Simulation“ on the adjustment module MINICOM, in the software program VVO or on the signal conditioning instrument.

You simulate a vessel filling and thereby a certain sensor current. Please note that connected instruments, such as e.g. a PLC, react according to their adjustments and will probably activate alarms or system functions.

Simulation with VVO
If you start the simulation mode with the adjustment program VVO on the PC, the simulated level is outputted until you quit the simulation mode.

Simulation with MINICOM
If you start the simulation mode on the adjustment module MINICOM, the sensor returns to standard operating mode after one hour.

7.2 Error codes

Error codes		Corrective measures
E013	No valid measured value - Sensor in the warm-up phase - Loss of the useful echo	Message is displayed during the warm-up phase If the message remains, a false echo storage (with the adjustment software on the PC - see "Echo curve“ under "Sensor optimisation“) must be carried out together with a modification of mounting location and orientation to achieve the lowest possible false echo background.
E017	Adjustment span too small	Carry out a readjustment. Make sure that the difference between min. and max. adjustment is at least 10 mm .
E036	Sensor software does not run	Sensor requires a software update (service). Message appears during a software update.
E040	Hardware failure/Electronics defective	Check all connection cables. Transducer defective. Contact our service department.

8 Function diagram and PA parameters

The following parameter listing and the function diagram are used for setup with the automation system, if no adjustment software is available. The listing represents the parameters of the function block and transducer block and is only meant for very experienced Profibus users. Make sure that all VEGA sensors are profile 3 sensors. Normally, you will carry out the setup of the sensors with greater ease using the VEGA adjustment software VVO or the adjustment module MINICOM in the sensor.

The PA parameters and the function diagram are generally not necessary for setup and are used to extend the knowledge of interested users who are able to read the measured values from the sensor into their processing system without adjustment tool.

8.1 Parameter listing

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
0	16	Block object	PB	Yes	No	DS-32	20		C		m
0	17	St rev	PB	Yes	No	Unsigned16	2	0	N		m
0	18	Tag desc	PB	Yes	Yes	Octet String	32	32*' '	S		m
0	19	Strategy	PB	Yes	Yes	Unsigned16	2	0	S		m
0	20	Alert key	PB	Yes	Yes	Unsigned8	1	0	S		m
0	21	Target mode	PB	Yes	Yes(*1)	Unsigned8	1		S		m
0	22	Mode blk	PB	Yes	No	DS-37	3		(D)		m
0	23	Alarm sum	PB	Yes	No	DS-42	8		D		m
0	24	Software revision	PB	Yes	No	Octet String	16		C		m
0	25	Hardware revision	PB	Yes	No	Octet String	16		C		m
0	26	Device man ID	PB	Yes	No	Unsigned16	2		C		m
0	27	Device ID	PB	Yes	No	Octet String	16		C		m
0	28	Device ser num	PB	Yes	No	Octet String	16		C		m
0	29	Diagnosis	PB	Yes	No	Octet String	4	-	D		m
0	31	Diagnosis mask	PB	Yes	No	Octet String	4		C		m
0	33	Device certification	PB	Yes	No	Octet String	32		C		o
0	34	Write locking	PB	Yes	Yes	Unsigned16	2	-	N		o
0	35	Factory reset	PB	Yes	Yes	Unsigned16	2	-	S		o
0	36	Decript or	PB	Yes	Yes	Octet String	32	-	S		o
0	37	Device message	PB	Yes	Yes	Octet String	32	-	S		o

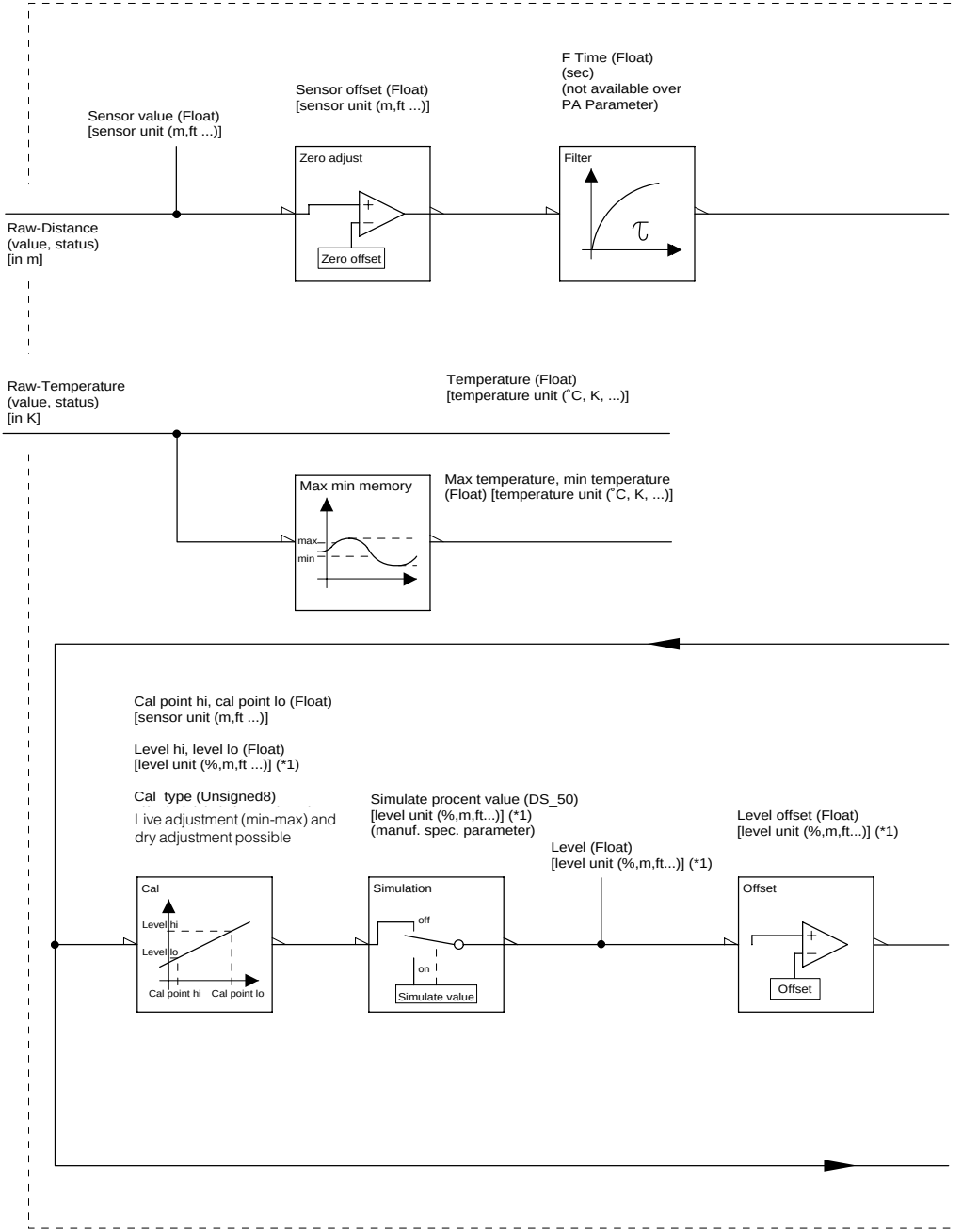
Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
0	38	Device install date	PB	Yes	Yes	OctetString	16	-	S		o
0	40	Ident number select	PB	Yes	Yes	Unsigned8	1	-	S		m
0	41	HW write protection	PB	Yes	No	Unsigned8	1		D		o
0	49	VVO	PB	Yes	Yes	OctetString	32				o
0	50	View object PB	PB	Yes	No	OctetString	17		D		m
1	0	Directory object header	DM	Yes	No	Array of Unsigned16	12		C		m
1	1	Composite list directory entries	DM	Yes	No	Array of Unsigned16	24		C		m
1	16	Block object	FB_Primary_Value	Yes	No	DS-32	20		C		m
1	17	St rev	FB_Primary_Value	Yes	No	Unsigned16	2	0	N		m
1	18	Tag desc	FB_Primary_Value	Yes	Yes	OctetString	32	32*' '	S		m
1	19	Strategy	FB_Primary_Value	Yes	Yes	Unsigned16	2	0	S		m
1	20	Alert key	FB_Primary_Value	Yes	Yes	Unsigned8	1	0	S		m
1	21	Target mode	FB_Primary_Value	Yes	Yes	Unsigned8	1	8	S		m
1	22	Mode blk	FB_Primary_Value	Yes	No	DS-37	3		D		m
1	23	Alarm sum	FB_Primary_Value	Yes	No	DS-42	8		D		m
1	24	Batch	FB_Primary_Value	Yes	Yes	DS-67	10	0,0,0,0	S		m
1	26	Out	FB_Primary_Value	Yes	Yes(*1)	DS-33	5		D	out scale unit	m
1	27	PV scale	FB_Primary_Value	Yes	Yes	2*Float	8	0,100	S	prim, sec1, sec2 value unit (dep. on channel)	m
1	28	Out scale	FB_Primary_Value	Yes	Yes	DS-36	11	0,100,-,-	S	includes out scale unit	m
1	29	Lin type	FB_Primary_Value	Yes	Yes(*1)	Unsigned8	1	0	S		m
1	30	Channel	FB_Primary_Value	Yes	Yes	Unsigned16	2	-	S		m
1	32	PV FTime	FB_Primary_Value	Yes	Yes	Float	4	0	N	sec	m
1	33	Fsafe type	FB_Primary_Value	Yes	Yes	Unsigned8	1	1	S		o
1	34	Fsafe value	FB_Primary_Value	Yes	Yes	Float	4	-	S	out scale unit	o
1	35	Alarm hys	FB_Primary_Value	Yes	Yes	Float	4	0.5% of range	S	out scale unit	m
1	37	HI HI Lim	FB_Primary_Value	Yes	Yes	Float	4	max value	S	out scale unit	m
1	39	HI Lim	FB_Primary_Value	Yes	Yes	Float	4	max value	S	out scale unit	m
1	41	LO Lim	FB_Primary_Value	Yes	Yes	Float	4	min value	S	out scale unit	m
1	43	LO LO Lim	FB_Primary_Value	Yes	Yes	Float	4	min value	S	out scale unit	m
1	46	HI HI Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	47	HI Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	48	LO Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	49	LO LO Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	50	Simulate	FB_Primary_Value	Yes	Yes	DS-50	6	disable	N	prim, sec1, sec2 value unit (dep. on channel)	m
1	61	View object FB_Primary_Value	FB_Primary_Value	Yes	No	OctetString	18		D		m
1	180	Display source select	TB	Yes	Yes	Unsigned8	1	?	N		o

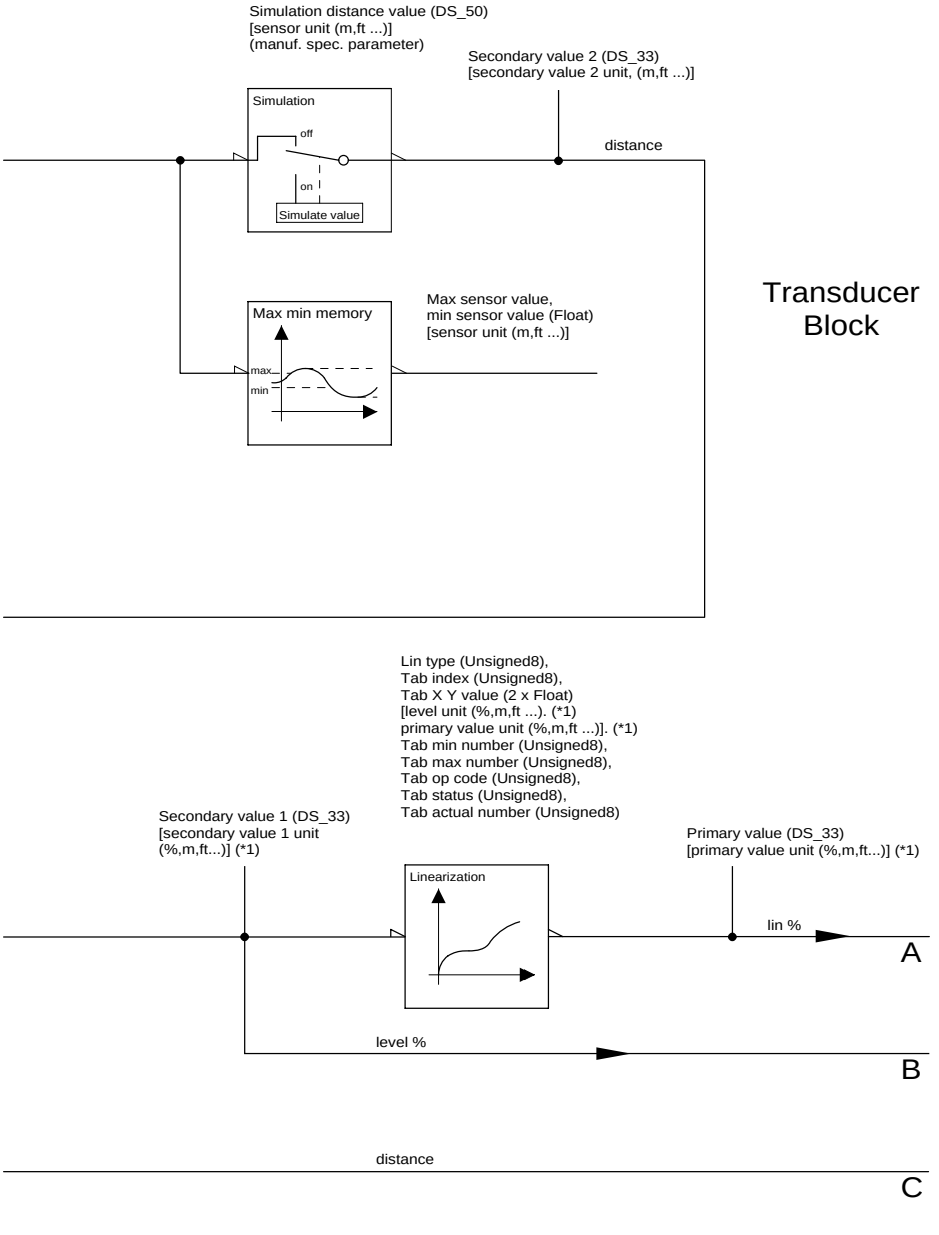
Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
1	120	Block object	TB_Level	Yes	No	DS-32	20		C		m
1	121	St rev	TB_Level	Yes	No	Unsigned16	2	0	N		m
1	122	Tag desc	TB_Level	Yes	Yes	Octet String	32	32*' '	S		m
1	123	Strategy	TB_Level	Yes	Yes	Unsigned16	2	0	S		m
1	124	Alert key	TB_Level	Yes	Yes	Unsigned8	1	0	S		m
1	125	Target mode	TB_Level	Yes	Yes(*1)	Unsigned8	1		S		m
1	126	Mode blk	TB_Level	Yes	No	DS-37	3		(D)		m
1	127	Alarm sum	TB_Level	Yes	No	DS-42	8		D		m
1	128	Primary value	TB_Level	Yes	No	DS-33	5		D	primary value unit	m
1	129	Primary value unit	TB_Level	Yes	Yes	Unsigned16	2	%	S		m
1	130	Level	TB_Level	Yes	No	Float	4		D	level unit	m
1	131	Level unit	TB_Level	Yes	Yes	Unsigned16	2	%	S		m
1	132	Sensor value	TB_Level	Yes	No	Float	4		D	sensor unit	m
1	133	Sensor unit	TB_Level	Yes	Yes	Unsigned16	2		S		m
1	134	Secondary value 1	TB_Level	Yes	No	DS-33	5		D	secondary value 1 unit	o
1	135	Secondary value 1 unit	TB_Level	Yes	Yes	Unsigned16	2		S		o
1	136	Secondary value 2	TB_Level	Yes	No	DS-33	5		D	secondary value 2 unit	o
1	137	Secondary value 2 unit	TB_Level	Yes	Yes	Unsigned16	2		S		o
1	138	Sensor offset	TB_Level	Yes	Yes	Float	4	0	S	sensor unit	m
1	139	Cal type	TB_Level	Yes	Yes	Unsigned8	1	oder Lifeabgleich	S		m
1	140	Cal point lo	TB_Level	Yes	Yes	Float	4		S	[sensor unit]	m
1	141	Cal point hi	TB_Level	Yes	Yes	Float	4		S	sensor unit	m
1	142	Level lo	TB_Level	Yes	Yes	Float	4	0	S	level unit	m
1	143	Level hi	TB_Level	Yes	Yes	Float	4	100	S	level unit	m
1	144	Level offset	TB_Level	Yes	Yes	Float	4	0	S	level unit	m
1	145	Lin type	TB_Level	Yes	Yes	Unsigned8	1	0 (=linear)	S		m
1	148	Sensor high limit	TB_Level	Yes	No	Float	4		C	sensor unit	o
1	149	Sensor low limit	TB_Level	Yes	No	Float	4		C	sensor unit	o
1	150	Max sensor value	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	sensor unit	o
1	151	Min sensor value	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	sensor unit	o
1	152	Temperature	TB_Level	Yes	No	Float	4		D	temperature unit	o
1	153	Temperature unit	TB_Level	Yes	Yes	Unsigned16	2	°C	S		o
1	154	Max temperature	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	temperature unit	o
1	155	Min temperature	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	temperature unit	o
1	156	Tab index	TB_Level	Yes	Yes	Unsigned8	1	1	D		o

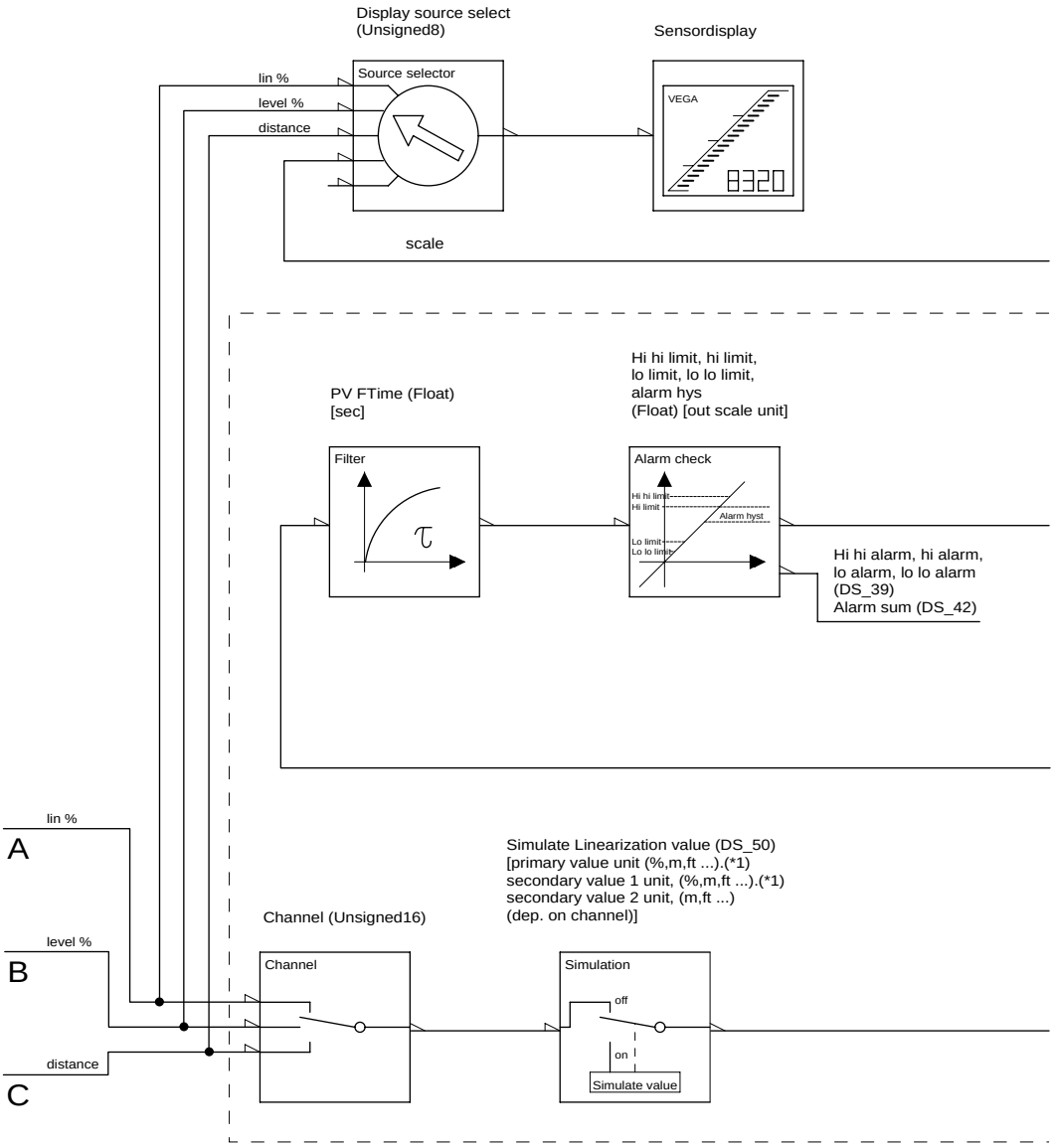
Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
1	157	Tab XY value	TB_Level	Yes	Yes	2*Float	8		N	secondary value 1 unit, primary value unit	o
1	158	Tab min number	TB_Level	Yes	No	Unsigned8	1		C		o
1	159	Tab max number	TB_Level	Yes	No	Unsigned8	1		C		o
1	160	Tab op code	TB_Level	Yes	Yes	Unsigned8	1		D		o
1	161	Tab status	TB_Level	Yes	No	Unsigned8	1		D		o
1	162	Tab actual number	TB_Level	Yes	No	Unsigned8	1		D		o
1	190	Simulate sensor value	TB_Level	Yes	Yes	DS-50	6	disable	N	sensor unit	o
1	191	Simulate level	TB_Level	Yes	Yes	DS-50	6	disable	N	level unit	o
1	192	Füllguttyp	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	193	Echo quality	TB_Level	Yes	No	Unsigned8	1		D	dB	o
1	194	First echo factor	TB_Level	Yes	Yes	Unsigned8	1	aus	N		o
1	195	Sound velocity	TB_Level	Yes	Yes	Float	4	ca. 331.6 (VEGA-Wert)	N	m/s	o
1	196	Lerndistanz	TB_Level	Yes	Yes	Float	4		D	sensor unit	o
1	197	Störechospeicher-Aktion	TB_Level	Yes	Yes	Unsigned8	1		D		o
1	198	Arbeitsbereich Ende	TB_Level	Yes	Yes	Float	4		N	sensor unit	o
1	199	Arbeitsbereich Anfang	TB_Level	Yes	Yes	Float	4		N	sensor unit	o
1	200	schnelle Meßwertänderung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	201	unruhige Füllgutoberfläche	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	202	Schaumbildung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	203	starke Staubentwicklung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	204	Bodenreflexion; großer Schüttwinkel	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	210	Korrekturfaktor Ausbr.geschw.	TB_Level	Yes	Yes	Float	4		N	%	o
1	211	Korrekturfaktor der Ausbr.geschw. per Distanzeingabe berechnen	TB_Level	No	Yes	Float	4		N	sensor unit	o
2	16	Block object	FB_Temperature	Yes	No	DS-32	20		C		m
2	17	St rev	FB_Temperature	Yes	No	Unsigned16	2	0	N		m
2	18	Tag desc	FB_Temperature	Yes	Yes	Octet String	32	32*' '	S		m
2	19	Strategy	FB_Temperature	Yes	Yes	Unsigned16	2	0	S		m
2	20	Alert key	FB_Temperature	Yes	Yes	Unsigned8	1	0	S		m
2	21	Target mode	FB_Temperature	Yes	Yes	Unsigned8	1	8	S		m

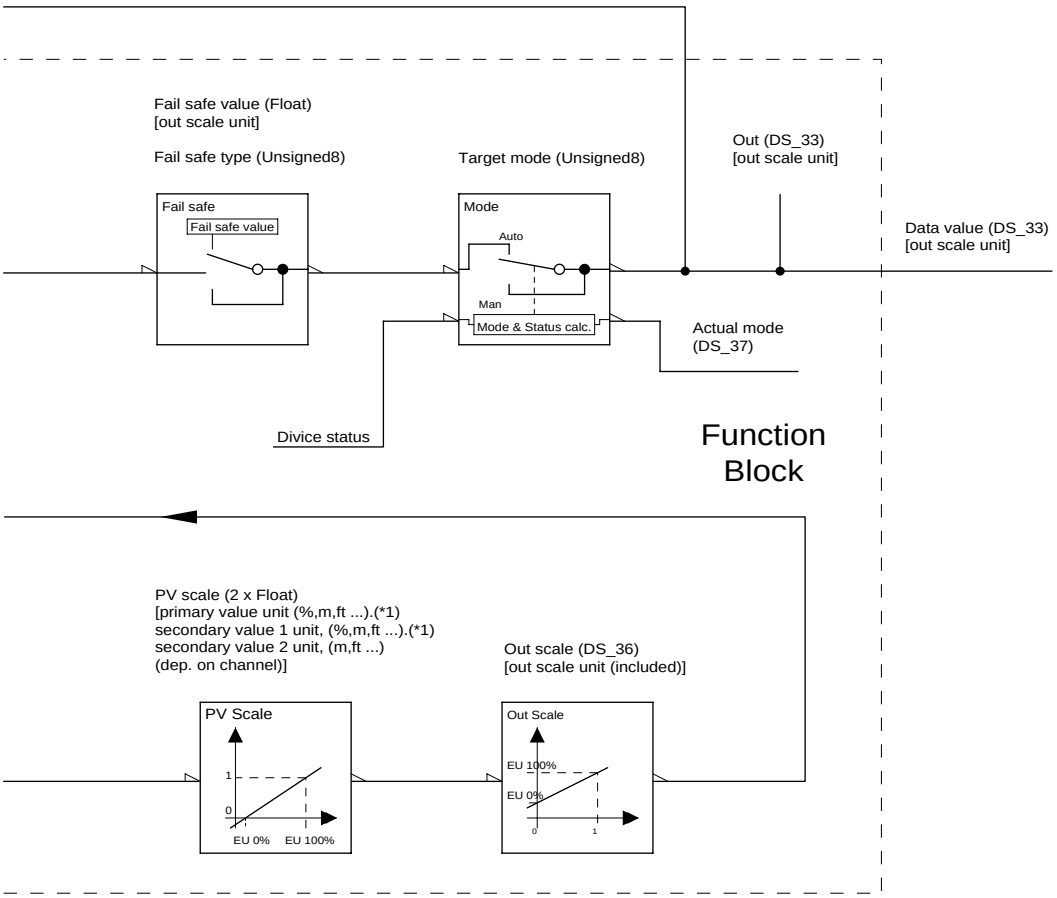
Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
2	22	Mode blk	FB_Temperature	Yes	No	DS-37	3		D		m
2	23	Alarm sum	FB_Temperature	Yes	No	DS-42	8		D		m
2	24	Batch	FB_Temperature	Yes	Yes	DS-67	10	0,0,0,0	S		m
2	26	Out	FB_Temperature	Yes	Yes(*1)	DS-33	5		D	temp out scale unit	m
2	27	PV scale	FB_Temperature	Yes	Yes	2*Float	8	0,100	S	temperature unit	m
2	28	Out scale	FB_Temperature	Yes	Yes	DS-36	11	0,100,-,-	S	includes temp out scale unit	m
2	29	Lin type	FB_Temperature	Yes	Yes(*1)	Unsigned8	1	0	S		m
2	30	Channel	FB_Temperature	Yes	Yes(*1)	Unsigned16	2	-	S		m
2	32	PV FTime	FB_Temperature	Yes	Yes	Float	4	0	N	sec	m
2	33	Fsafe type	FB_Temperature	Yes	Yes	Unsigned8	1	1	S		o
2	34	Fsafe value	FB_Temperature	Yes	Yes	Float	4	-	S	temp out scale unit	o
2	35	Alarm hys	FB_Temperature	Yes	Yes	Float	4	1K	S	temp out scale unit	m
2	37	HI HI Lim	FB_Temperature	Yes	Yes	Float	4	max value	S	temp out scale unit	m
2	39	HI Lim	FB_Temperature	Yes	Yes	Float	4	max value	S	temp out scale unit	m
2	41	LO Lim	FB_Temperature	Yes	Yes	Float	4	min value	S	temp out scale unit	m
2	43	LOLO Lim	FB_Temperature	Yes	Yes	Float	4	min value	S	temp out scale unit	m
2	46	HI HI Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	47	HI Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	48	LO Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	49	LOLO Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	50	Simulate	FB_Temperature	Yes	Yes	DS-50	6	disable	N	temperature unit	m
2	61	View object FB_Temperature	FB_Temperature	Yes	No	Octet String	18		D		m

8.2 Function diagram




Simulation distance value (DS_50)
[sensor unit (m,ft ...)]
(manuf. spec. parameter)
Secondary value 2 (DS_33)
[secondary value 2 unit, (m,ft ...)]
Simulation
off
on
Simulate value
distance
Max min memory
max
min
Max sensor value,
min sensor value (Float)
[sensor unit (m,ft ...)]
Transducer Block
Lin type (Unsigned8),
Tab index (Unsigned8),
Tab X Y value (2 x Float)
[level unit (%,m,ft ...). (*1)
primary value unit (%,m,ft ...)]. (*1)
Tab min number (Unsigned8),
Tab max number (Unsigned8),
Tab op code (Unsigned8),
Tab status (Unsigned8),
Tab actual number (Unsigned8)
Secondary value 1 (DS_33)
[secondary value 1 unit
(%,m,ft...)] (*1)
Linearization
Primary value (DS_33)
[primary value unit (%,m,ft...)] (*1)
lin %
A
level %
B
distance
C


Display source select
(Unsigned8)
Sensordisplay
Source selector
lin %
level %
distance
VEGA
8320
scale
PV FTime (Float)
[sec]
Hi hi limit, hi limit,
lo limit, lo lo limit,
alarm hys
(Float) [out scale unit]
Filter
Alarm check
Hi hi limit
Hi limit
Alarm hyst
Lo limit
Lo lo limit
Hi hi alarm, hi alarm,
lo alarm, lo lo alarm
(DS_39)
Alarm sum (DS_42)
lin %
A
level %
B
distance
C
Channel (Unsigned16)
Simulate Linearization value (DS_50)
[primary value unit (%,m,ft ...).(*1)
secondary value 1 unit, (%,m,ft ...).(*1)
secondary value 2 unit, (m,ft ...)
(dep. on channel)]
Channel
Simulation
off
on
Simulate value


Fail safe value (Float)
[out scale unit]
Fail safe type (Unsigned8)
Target mode (Unsigned8)
Out (DS_33)
[out scale unit]
Fail safe
Fail safe value
Mode
Auto
Man
Mode & Status calc.
Data value (DS_33)
[out scale unit]
Actual mode
(DS_37)
Divice status
Function
Block
PV scale (2 x Float)
[primary value unit (%,m,ft ...).(*1)
secondary value 1 unit, (%,m,ft ...).(*1)
secondary value 2 unit, (m,ft ...)
(dep. on channel)]
Out scale (DS_36)
[out scale unit (included)]
PV Scale
1
0
EU 0%
EU 100%
Out Scale
EU 100%
EU 0%
0
1

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The statements on types, application, use and operating conditions of the sensors and processing systems correspond to the latest information at the time of printing.

Technical data subject to alterations

2.24 961 / May 2000